SURGICAL DIAGNOSIS

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TO AGNES

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Head

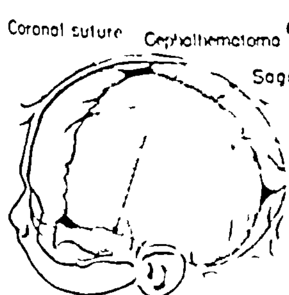
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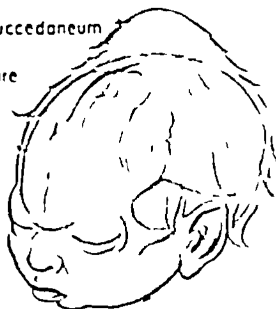
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Coronal suture
Cephalhematoma
Sagittal suture
Parietal bone


Caput succedaneum

succedaneum The latter is a circumscribed edema with ecchymosis which results from prolonged pressure in the birth canal. It is differentiated from cephalhematoma by the fact that a caput is not limited by the cranial sutures (Fig 1)

Avulsion of the scalp is the tearing away of this structure from the skull The most common causes in modern times are beauty parlor and industrial accidents The separation occurs in the subaponeurotic layer usually the pericranium is left intact.

Infections

Boils and carbuncles of the scalp are extremely painful, since this structure is thick and inelastic. In the aged, diabetic or asthenic serious sequelae can result. The infection penetrates beneath the aponeurosis. In such instances the distribution would be the same as that described under "Hematoma (p 1) Erysipelas and cellulitis may follow abrasions or trivial wounds Pain edema, fever regional lymphadenitis and leukocytosis are characteristic.

Osteomyelitis of the cranial bones usually is associated with a superimposed infection *Pott s puffy tumor* is a circumscribed edema of the scalp associated with such osteomyelitis A roentgenogram isolates the involved bone.

Cysts

Sebaceous cysts frequently occur in the scalp (wens) they are often multiple. Suppuration ulceration or epitheliomatous degeneration are sequelae of such cysts A localized swelling *in* the scalp can be moved on the skull. A swelling which originates from the bony skull permits the scalp to be moved over the swelling (Fig 2)

Dermoid cysts are rarely seen They occasionally communicate by a narrow neck with the subdural space.

Tumors

Both benign and malignant tumors can originate from the scalp These must be suspected when the lesion moves with the scalp over the underlying bone In this respect

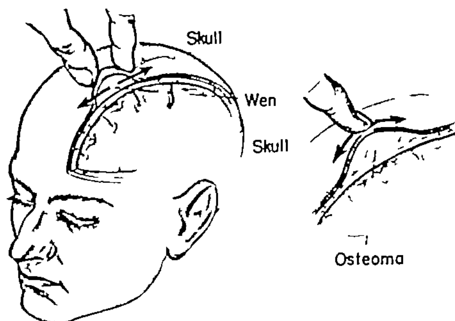
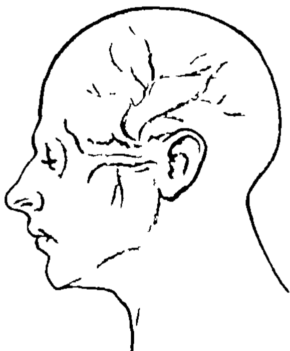
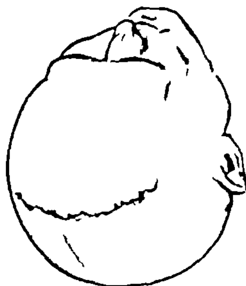


Fig 2 A sebaceous cyst moves with the scalp over the skull. The scalp moves over an osteoma.





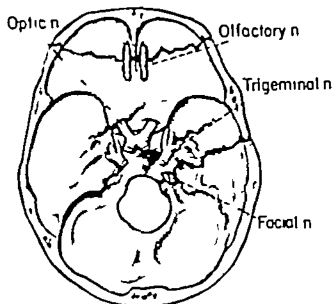




FIG 3 Soft tissues which may be injured in skull fractures.

the tumor resembles a sebaceous cyst Secondary tumors may also affect the scalp

A **cirsoid aneurysm** occasionally involves the scalp particularly in the region of the superficial temporal artery It results from an arteriovenous fistula (congenital or traumatic) Enormous tortuous veins and arteries course over the scalp and the temple of the involved side

SKULL

The contour of the skull may vary tremendously and still be within normal limits A definite relationship to race is noted A *dolichocephalic* skull is elongated *Brachycephalic* skulls are round *Megacephalic* skulls have a capacity of over 1 450 cc. and are found in the highly civilized. *Microcephalic* skulls have a capacity of less than 1,300 cc. and are found in the more primitive types

Diseases

Osteomyelitis may occur as a primary condition or secondary to furuncles carbuncles, burns and infected hematomas. This has been alluded to on page 2

Other diseases which affect the skull are rickets, syphilis tuberculosis Paget s disease and xanthomatosis

Tumors arising from the skull are usually osteomas Also benign giant cell tumors have been reported Sarcoma may be primary or secondary

Fractures

Since the skull is not a weight bearing structure, the fracture per se is unimportant from a structural standpoint Of great significance is the damage to the vessels the meninges and the brain (Fig 3)

These fractures will be discussed as

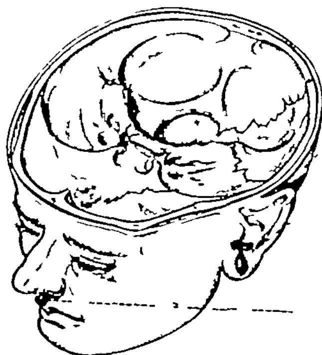


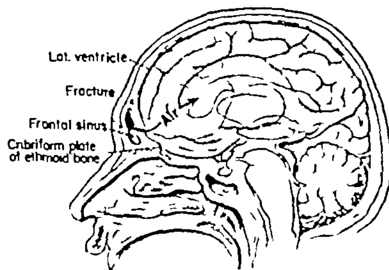
Fig. 4 Basal skull fractures may involve any one or all of the 3 fossae in the base of the skull. The outlet of the anterior fossa is the nose, of the middle fossa the ear The posterior fossa has no outlet but must be suspected of having a fracture when a hematoma develops in the region of the mastoid process.

vault, *basal* and *depressed* fractures. Any combination of these may occur.

Vault Fractures. Fractures of the vault are the most common type and are usually *linear*. If uncomplicated they are of little significance except that they serve as evidence of injury. *In children* such fractures lead to absorption of the surrounding bone and for some unknown reason may produce a round defect in the bone. The margins of these defects are smooth and regular. Vault fractures which occur in the temporal region may cause a laceration of the middle meningeal vessels (p. 8). Extension of linear vault fractures into the base of the skull is not uncommon. *Healing* of linear fractures usually is complete in normal children from 6 to 12 months of age but in adults such fracture lines may remain open for years. In the latter instance the edges of the fracture are smoother and round.

Basal Fractures. Basal skull fractures may involve one or more of the 3 fossae (Figs 3 C 4). Unlike fractures of the vault, fractures of the base are often overlooked on the roentgenogram, hence the importance of their clinical evaluation.

Anterior Fossa Fractures. Fractures of the *anterior fossa* often involve the cribriform plates of the ethmoid bone and the paranasal sinuses (Fig. 5). Fractures involving the orbital roof may be associated with intra-ocular extravasation of blood with resultant ecchymosis of the eyelids. A gradual increase in the suffusion of blood in the *eyelids*, particularly the lower lids, in the absence of direct trauma is strongly suggestive of an anterior fossa basal skull fracture. In severe cases exophthalmos may result; this may be severe enough to endanger the eye. Involvement of the paranasal sinuses and/or the cribriform plate is of importance in that they provide an entrance for infection. Fractures of the *cribriform plate* are frequently associated with the escape of blood, cerebrospinal fluid or brain tissue from the nose. A fracture through the frontal sinus may also be associated with a pneumocephalus (air in the cranial cavity). Such air may become encysted in the frontal lobe or enter the ventricular system. Fractures in this fossa may injure the *optic* and the *olfactory* nerves. If the olfactory nerves are involved, a partial or



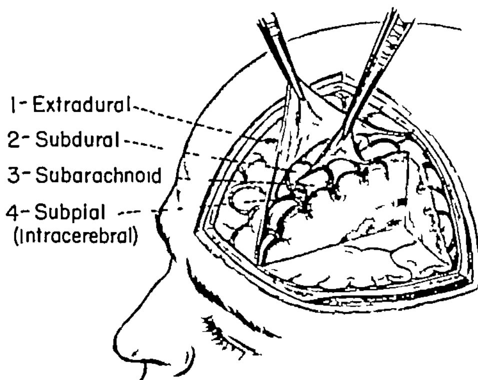


FIG 6 The 4 intracranial spaces and associated intracranial hemorrhages. Extradural hemorrhage is usually arterial hemorrhage (middle meningeal artery) Subdural hemorrhage originates from the blood sinuses and is therefore venous. Subpial hemorrhage is intracerebral and is associated with hyper tension (apoplexy) or ruptured aneurysms of the circle of Willis.

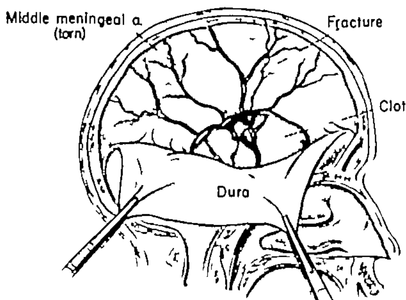


FIG 7 Extradural hemorrhage (middle meningeal artery hemorrhage) The fracture that produces this type of bleed ing involves the temporal bone As the hemorrhage progresses the dura is stripped away from the bone

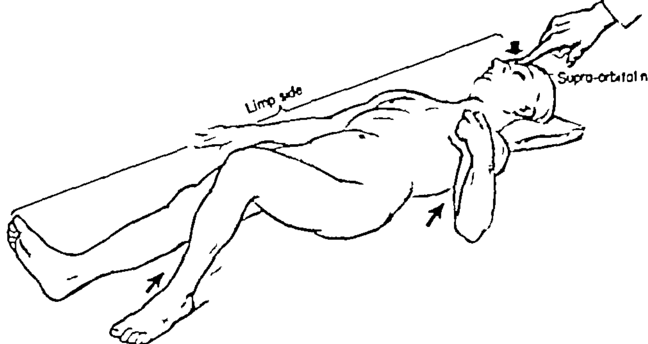


FIG 8 The supra-orbital test applied to an unconscious patient If a hemiplegia is present the patient responds to this painful stimulus by moving the sound side The affected side remains limp

total loss of the sense of smell may result If the fracture extends through the optic foramen usually the optic nerve is injured (p 13)

Middle Fossa Fracture These injuries may involve the temporal bone In such instances blood spinal fluid or brain tissue may appear at the external auditory meatus The cranial nerves which can be involved in this fossa are 3, 4 5 6 7 and 8 The seventh (facial) and the eighth (auditory) are involved most commonly this results in facial paralysis or auditory vestibular involvements, respectively

Posterior Fossa Fracture When this fossa is involved, blood or spinal fluid may pass into the pharynx. *Battle's sign* (post auricular ecchymosis) is suggestive of a posterior fossa fracture Unfortunately this does not appear for 24 to 36 hours The nerves that may be involved in this fossa are the ninth the tenth and the eleventh (p 13)

Depressed Fracture Depressed skull fractures are important because they may produce brain injury and convulsions Depressed fractures in the central area over the motor and the sensory zones or in the occipital region over the visual areas are particularly dangerous Those involving the frontal or temporal region are not as serious

Contrecoup injury is found at a site away from the direct location of the trauma

The interpretation and the value of spinal puncture and the study of spinal fluid are discussed on page 10

MENINGES AND RELATED BLOOD VESSELS

The meninges the pia the arachnoid and the dura mater are vulnerable in head and spinal injuries The pia mater dips into each fissure of the brain thereby fitting very much as a glove would fit a hand However the dura and the arachnoid do not dip into the fissures but rather cover the brain as a mitten would cover the hand

Clinically it is helpful to discuss intra

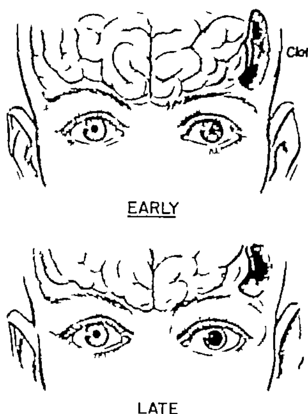


Fig 9 The pupil as a diagnostic aid in extradural hemorrhage In the early stage the pupil on the involved side is small and reacts to light. In the late stage the pupil on the involved side is dilated and does not react to light. Prognosis is poor when both pupils are dilated and fixed.

cranial hemorrhage as related to 4 spaces (Fig 6)

1 The extradural space
2 The subdural space
3 The subarachnoid space
4 The subpial space

Intracranial Hemorrhage

Extradural Hemorrhage. This type of hemorrhage may occur with or without a skull fracture Fractures involving the vault, particularly the temporal region cause a laceration of the middle meningeal vessels. Many authorities believe that it is the bleeding middle meningeal artery which strips the dura away from the skull (Fig 7) In the classical picture the patient becomes unconscious following a blow on the head He then recovers consciousness (lucid interval) but later becomes drowsy, lapses *into coma and if untreated he dies. This* clinical picture is subject to the widest of variations, even occurring without a lucid interval

The clot produces increased intracranial tension with pressure upon the brain *Hemiplegia* in an unconscious patient can be demonstrated by making firm pressure over a supraorbital nerve. (Fig 8) This produces a painful stimulus to which the patient responds by moving only the sound side The affected side remains limp Corroborating signs such as the presence of increased deep reflexes absent abdominal reflexes and Babinski s sign should be sought on the affected side A monoplegia may be the first sign of an extradural hemorrhage The arm is affected more often than the leg

The *pupils* may be of value in both localizing and diagnosing the lesion At first the pupil on the involved side is small and reacts to light however, later it becomes dilated and fixed (Fig 9) The *spinal fluid* is also a valuable diagnostic aid Following a head injury an insidious onset of coma and hemiplegia, along with a clear spinal fluid, is suggestive of *extradural hemorrhage* Any force sufficiently great to rupture the meningeal vessels may rupture cerebral vessels also hence, both intradural and extradural bleeding may occur together The differential diagnosis of bloody spinal fluid is discussed on page 10 Increased pressure of spinal fluid suggests increased intracranial pressure which may be due to one of many causes

Subdural Hemorrhage The condition of so-called chronic subdural hematoma is more common than extradural hemorrhage. The trauma responsible for the hemorrhage may be trivial and forgotten In about a fourth of these patients a history of loss of consciousness is elicited The condition usually manifests itself 2 or 3 weeks after the head injury The common complaints are headache and diplopia. Intermittent somno-

lence and weakness of one side of the body are due to a seepage of blood over the cerebral hemispheres The superior sagittal sinus is fixed to the skull and is immovable in contrast with the brain which moves on impact The superior cerebral veins pass from the superior surface of the brain into the superior sagittal sinus A blow on the head may tear one or more of these veins (Fig 10) Examination of the eye grounds will show blurring of the optic disk or papilledema in about half of the cases Spinal fluid examination reveals an elevated pressure the fluid has a yellowish tinge (50%) The pupil on one side may become dilated and fixed Roentgenograms of the skull at times show a shift of a calcified pineal body away from the side of the lesion Electro-encephalograms pneumo-encephalograms and ventriculo-encephalograms are helpful if the patient s condition permits

Chronic subdural hematoma in infants occurs usually between 6 months and 2 years of age The etiology is obscure however some are of the opinion that it is associated with mild head trauma particularly in children who are malnourished and have a vitamin C deficiency and a bleeding tendency

Subarachnoid Hemorrhage This may or may not be associated with trauma Its value in traumatic lesions has been discussed under the caption of "Extradural and Subdural Hemorrhages" (p 8) The condition referred to as *spontaneous subarachnoid hemorrhage* is a vascular accident which occurs in younger and middle-aged people It is due to a rupture of an aneurysm of the circle of Willis Such aneurysms are usually congenital but in older people are arteriosclerotic Severe meningeal irritation with stiff neck and positive Brudzinski and Kernig signs is demonstrable If the bleeding is massive deep coma results A dilated pupil may be present on the side of the hemorrhage cranial nerve involvement will help to lo-

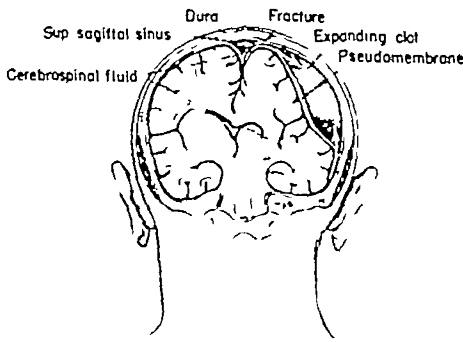


Fig 10 Subdural hematoma. The superior cerebral veins pass from the superior surface of the brain to the superior sagittal sinus. A blow on the head may tear one of these veins or the sinus.



FIG 11 Roentgenogram revealing typical digital impressions of the skull in a case of brain tumor

calize the lesion A final diagnosis is made by the demonstration of frank blood in the cerebrospinal fluid which is under high pressure The question may arise as to whether or not the blood is due to the spinal puncture This can be determined in 2 ways In using the first method the bloody spinal fluid should be collected in 3 marked test tubes (about 3 cc. in each) if the blood is due to trauma of the spinal puncture the fluid becomes clearer and less bloody from the first to the third tube If the blood is due to a head injury it is intimately mixed with spinal fluid and the 3 test tubes contain an equal amount of blood and show no color changes In the second method one permits the collected bloody spinal fluid to stand in a given test tube for 24 hours In intracerebral bleeding the supernatent fluid is yellow otherwise it remains crystal clear

Cerebral vascular spasm, hemorrhage, thrombosis and embolism also must be considered in the differential diagnosis of spontaneous cerebrovascular accidents.

Subpial Space Hemorrhage. This is intracerebral hemorrhage since the pia is so intimately connected with brain tissue that both structures act as one unit.

BRAIN

Cerebral Edema and Increased Intracranial Pressure

Brain swelling may be caused by other conditions besides trauma however it is the latter that is pertinent to this discussion Since the brain and the meninges are enclosed within the rigid bony skull, little room is available for expansion As the brain swells intracranial pressure increases and presents definite signs and symptoms These are important guides for the clinician since prognosis and treatment directly depend upon them

Signs of Cerebral "Decompensation"

The greater the brain swelling the greater the intracranial pressure Swollen brains decompensate " The signs of such "decompensation are

1 Deepening coma
2 Increasing fever
3 Slowing of the pulse
4 Irregularities of respiration
5 Elevation of blood pressure

Coma is in direct proportion to cerebral edema If a patient enters the hospital in coma and later becomes lucid, the brain is compensating ' Should the reverse be true the brain is decompensating "

The temperature rises as the brain swells If the patient is in a state of shock the temperature will drop rapidly and become subnormal.

FIG 12 The 12 cranial nerves. These nerves originate from the base of the brain and therefore are exposed to injury in basal skull fractures. Simple and rapid tests must be utilized to determine such injuries A test for each nerve is discussed in the text.

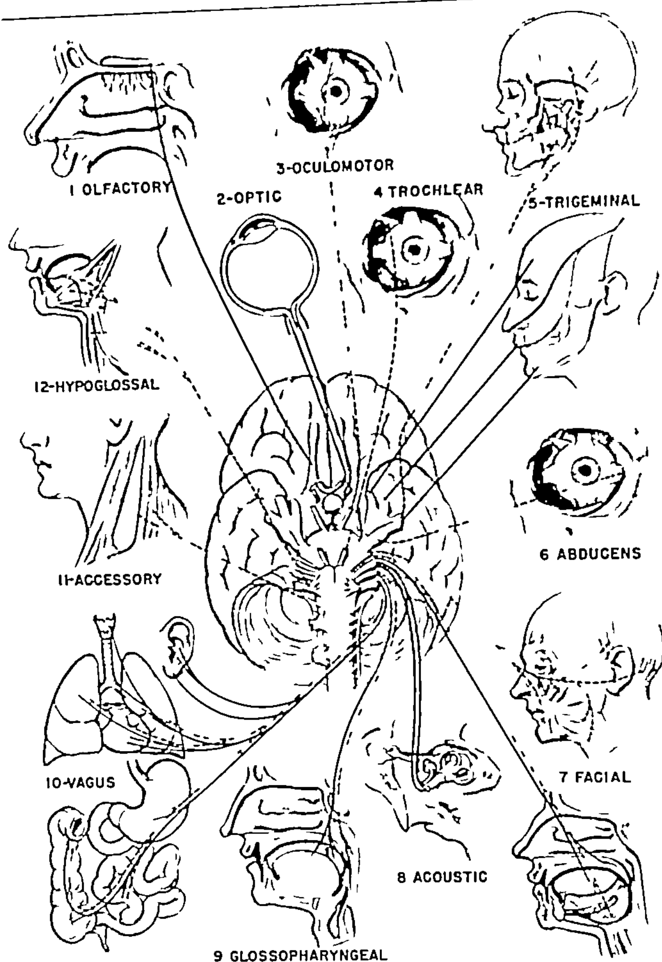


FIG 12 (*Caption on facing page*)

The pulse becomes slower as the brain swells Progressive bradycardia indicates increasing intracranial pressure If shock is present, this changes to the typical rapid feeble thready pulse The respirations are regular and of normal depth if cerebral edema is not increased When the respirations become shallow sonorous deep or irregular, intracranial pressure is increasing The systolic blood pressure rises as the brain swells and "decompensates.

The forementioned 5 signs should be *recorded* and *charted* in every head injury patient every hour on the hour In this way one can determine readily if a patient is improving or requires surgical treatment.

Tumors

The subject of brain *tumors* is discussed in detail in appropriate texts however, such lesions also produce signs of increased intracranial pressure and may cause confusion A classical *triad* is associated with such tumors It consists of headache, vomiting and choked optic disks The roentgenogram may be of value in diagnosing increased intracranial pressure In children there is a separation of the suture lines In adults erosion of the posterior clinoid processes may be shown. If the pressure is of long duration the so-called "digital impressions' produce a characteristic blotchy appearance of the calvarium (Fig 11)

CRANIAL NERVES

Simple, rapid and accurate testing of the 12 cranial nerves should be mastered (Fig 12) The necessary data for such tests is tabulated. The more detailed examination can be found in texts on neurology

2

The Oral Cavity

An exact and detailed examination of the oral cavity is essential because of the numerous local lesions that may be present and the many clues to systemic diseases that can be uncovered. Lips, tongue, oropharynx, tonsillar area and teeth must be studied systematically.

LIPS

The lips should be everted so that the entire mucosal surface can be inspected. Examination of the cervical lymph glands should be included in the routine evaluation of a lip lesion.

Cancer of the lip occurs predominately in the male. It appears usually after the age of 50. It resembles a superficial "split" or a warty excrescence but feels indurated. The *lower* lip is involved most frequently.

Leukoplakia is a whitish translucent patch that appears at the corners of the buccal cavity.

Primary chancre may simulate cancer but usually involves the upper lip. Diagnosis is established by darkfield demonstration of the *Spirochaeta pallida*; the serologic tests are usually negative in this stage.

Herpes labialis appears as a tender elevated crusted plaque. Absence of ulceration, its short duration and lack of induration are its distinguishing features.

TONGUE

Carcinoma of the tongue is the most common malignant lesion of the oral cavity. A dental ulcer is a frequent precursor of such a lesion. Particular importance should be attached to the cutting edge of a broken tooth or an irregularity on a denture placed directly opposite the lesion. A malignant lesion is hard; frequently it is associated with a necrotizing ulcer. Metastases occur early and usually involve the submental and submaxillary lymph nodes when the anterior two thirds of the tongue is involved. If the tumor is located in the posterior third or base of the tongue, the deep cervical nodes are affected.

Fissuring of the tongue should be noted (Fig. 13). Horizontal fissures are usually normal and of no clinical significance; longitudinal fissuring is strongly suggestive of a luetic glossitis.

Tuberculosis produces a very painful yet superficial ulcer of the tongue. It is almost always associated with active pulmonary tuberculosis. The demonstration of the specific bacilli and biopsy determine the diagnosis.

Vitamin deficiencies can be diagnosed by careful inspection of the tongue.

When whitish patches appear one should suspect monilia, particularly if vigorous antibiotic therapy has been instituted.

OROPHARYNX

Tonsils. Enlarged tonsils must not be confused with pathologic ones, and detritus in the tonsillar crypts must not be mistaken for pus. Acute tonsillitis is associated with a "sore throat," and the tonsils appear

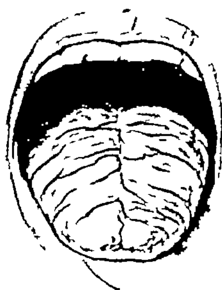




FIG 13 The diagnostic value of fissures on the tongue. Normal fissures run horizontally longitudinal fissures suggest lues.

swollen and red Recurrent attacks result in scarring and distortion (chronic tonsillitis) In peritonsillar abscess the involved tonsil appears to be pushed toward the opposite side Carcinoma tuberculosis and lymphoma of the tonsils are encountered occasionally

Retropharyngeal abscess usually affects infants and children It presents a protrusion of the posterior pharyngeal wall Palpation of any inflammatory lesion involving this area should be performed with the patient in the Trendelenburg position because of the danger of aspirating the contents if an abscess is broken inadvertently Neoplasms that involve this area must be differentiated

TEETH

Infections arising from the teeth constitute a major cause of swelling about the jaws the lower two thirds of the face and the upper part of the neck Odontogenic infections usually spread by direct continuity, the lymphatics assume a place of secondary importance The extension of dental abscesses follows the lines of least resistance. Location of local swelling is dependent upon the situation of the particular tooth involved and its anatomic relationship to bone, fascia and muscle (Fig 14) If the maxillary teeth are involved an alveolar abscess may perforate into the vestibule the antrum, the palate or even regions separated by muscular attachments A vestibular abscess reveals a shiny fluctuant swelling in the region of the root apex or slightly below it. When premolars or molars are involved the submaxillary area is affected, and a swelling appears below the mandible which obliterates the lower mandibular border This is extremely tender

Nasal cavity
Int jugular v
Mandible
Ext carotid a
Pharynx
Antrum
Buccinator m
Vestibule of mouth
Mandible
Submaxillary gland
Sublingual gland
Digastric m
Masseter m
Int pterygoid m
Buccinator m

Fig 14 Odontogenic infections Infections arising from the teeth produce swellings about the jaws the face and the neck They may be confused with and must be differentiated from enlargements of the cervical lymph glands and particularly the salivary glands

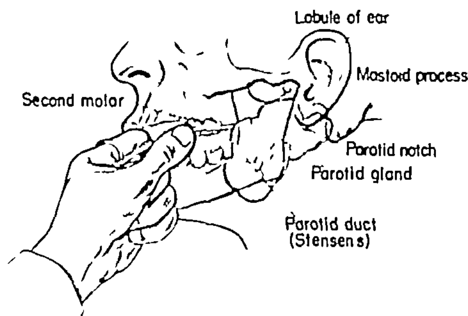


Fig 15 The parotid gland and Stensen s duct. The duct orifice is opposite the upper second molar The posterior aspect of the gland is related to the lobe of the ear and is situated between the angle of the jaw and the mastoid process (parotid notch)

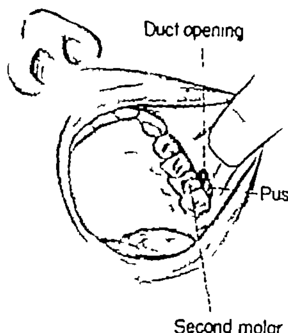


Fig 16 The orifice of Stensen s duct. Pus may be seen exuding from the opening of the parotid gland.

and may be associated with trismus The differential diagnosis is concerned primarily with lymphadenitis and sialadenitis. Involvement of submaxillary glands rarely obliterate the line of the jaw pus may be seen at the opening of Wharton s duct Submaxillary abscesses can pass into the sublingual space and produce an elevation of the floor of the mouth with displacement of the tongue The submental area becomes infected when pus burrows past the digastric muscle

Ludwig s angina is a form of deep infection that involves the floor of the mouth the submaxillary regions and the deep tissues of the neck as far as the hyoid bone It is often bilateral this is in contrast with the unilateral deep cervical abscess Extensive induration and swelling of the floor of the mouth appears early and the tongue is pushed upward and backward, thus interfering with swallowing and breathing Edema of the glottis is a serious complication that can be fatal before redness and fluctuation are apparent in the neck

SALIVARY GLANDS

Parotid Gland

Inflammation. Acute suppurative *parotitis* results from an infection which usually spreads via Stensen s duct (Fig 15), it may be a manifestation of pyemia. It is noted particularly in dehydrated patients and in those who have oral sepsis and duct stasis So-called ' surgical mumps ' is a serious postoperative complication. The onset is usually abrupt and is ushered in with chills, fever and a painful, tender parotid gland Inspection reveals a prominent and red duct orifice from which blood or pus may be expressed (Fig 16) As a rule only one gland is involved, but should the disease continue, the opposite side also can become affected

The causative agent is usually staphylococcus Although the parotid capsule is thick, the enlarged gland stands out as a diffuse swelling related to the ear and extending downward and backward over the angle of the jaw The differential diagnosis

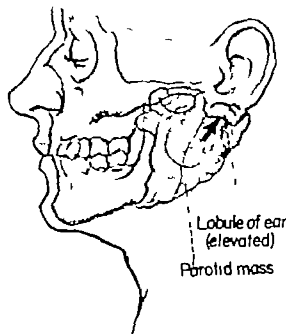


Fig. 17 Relation of the parotid gland to the lobule of the ear If a parotid mass is located in the region of the ear lobule, the latter is elevated.



FIG 18 Retention cyst of the parotid gland Enlargements of the gland are not always due to tumors Note the absence of facial nerve involvement

between cervical adenitis, preauricular adenitis and parotitis may be difficult The location of a lesion associated with lymph adenitis is of great diagnostic importance When pus or blood is seen at the orifice of Stensen s duct the diagnosis of parotid involvement is certain

Tumors. The numerous classifications of salivary gland tumors are of greater value to the pathologist than to the clinician It is practical to consider such tumors as mixed tumors or frank carcinomas

A *mixed tumor* of the parotid gland is not regarded as a true teratoid tumor Some experts considered it a carcinoma of low grade malignancy Such tumors are apt to recur and metastasize late Obvious carcinomas take a more rapid course and metastasize readily

That space that exists between the tip of the mastoid process and the angle of the jaw is the parotid notch This area is filled with the parotid gland and from here the gland extends in front of and behind the ear (Figs 15 16) Since the lobule of the ear covers this notch *any* parotid swelling involving this region elevates it (Fig 17)

When a tumor is present, usually the gland is diffusely enlarged, somewhat movable firm but not tender A carcinoma of the gland is usually indistinguishable from a mixed tumor Involvement of the seventh cranial nerve occurs in cancer more frequently than in benign lesions that affect the gland (Fig 18) The branches of this nerve must be tested since only one portion of the nerve may be involved



FIG 19 Roentgenogram revealing a calculus in the submaxillary (Wharton s) duct Roentgenographic corroboration of such sialoliths is frequently possible because these stones have a high mineral content.

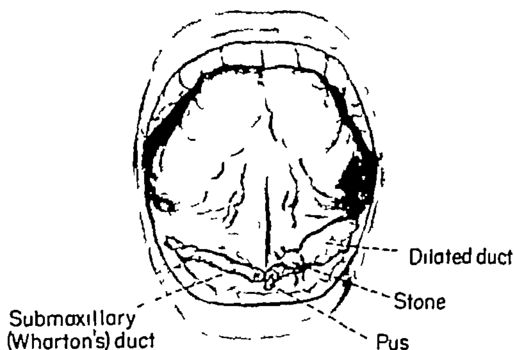


FIG 20 A calculus in the submaxillary (Wharton s) duct. Examination of the floor of the mouth reveals the edematous duct orifice and a drop of pus which can be expressed easily The duct is dilated proximal (as the saliva flows) to the stone.

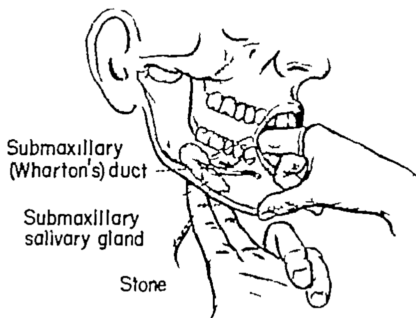


FIG 21 Palpation of the submaxillary gland and duct. The gloved intra-oral finger strokes the duct distally (arrow) This permits an evaluation of the duct and frequently locates the stone and expresses pus.

SUBMAXILLARY SALIVARY GLAND

Although acute pyogenic inflammation is encountered more frequently in the parotid gland, chronic inflammatory processes affect the submaxillary gland more frequently. These are usually secondary to obstructions of Wharton's duct. Frequently such obstructions are caused by calculi, or mucous plugs (Fig 19). The history is quite stereotyped. The patient complains of a painful mass below and in front of the angle of the jaw; this is associated with the ingestion of a meal; eating tart foods like lemon and pickles usually is associated with the pain. Inspection of the floor of the mouth reveals a red and edematous orifice of Wharton's duct (Fig 20). By means of bidigital palpation the course of the duct and the firm calculus usually can be felt (Fig 21). The roentgenogram corroborates the presence of the stones since they are rich in mineral salts. The gland is enlarged and tender and may be confused with submaxillary lymphadenitis. It is important to examine thoroughly the mouth and the pharynx for foci of infection that may be associated with lymphadenitis. Metastatic tumors also appear in this region.

Mixed tumors and carcinomas of the submaxillary salivary glands do occur but are less common than in the parotid.

SUBLINGUAL GLAND

The term *ranula* is associated with the sublingual salivary gland. This is a mucous gland that undergoes myxomatous degeneration (Fig 22). The involved gland is usually the sublingual but one of the solitary glands that are present over the buccal mucous membrane also may be affected.

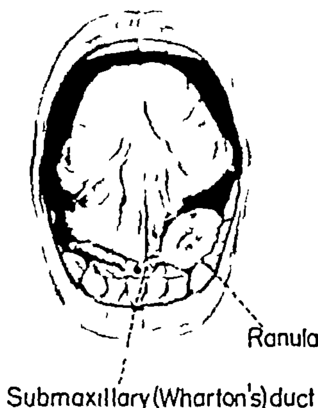


FIG 22. Ranula. This cystic swelling of one of the sublingual glands is close to the submaxillary (Wharton's) duct but is not connected with it.

A ranula appears as a unilateral transparent cystic swelling in the floor of the mouth. It was so named by Hippocrates since he likened it to the swelling of a frog's belly. Wharton's duct can be identified as an opaque band that traverses the anterior wall of the cyst. Although the cyst displaces the duct, it is in no way directly associated with it. Ranulas may have a cervical prolongation; hence palpation beneath the jaw and the upper cervical region should be included in the examination.

3

Neck

The diagnosis of a given neck lesion may be extremely simple or so difficult that a final diagnosis can be reached only by exploration and biopsy. Examination of the neck always should be integrated with that of the head, the face and the oral cavity. The muscles, bone and cartilaginous structures may not only mask the lesion but in themselves may be mistaken for a pathologic process.

Orientation and relation to the osseocartilaginous framework must be determined. Is the lesion in the mid line? Is the lesion in the anterior or the posterior cervical triangle? What is the relation of the lesion to the sternocleidomastoid muscle? Is it single or multiple? What are its physical properties? It will be found helpful if these 5 questions are answered systematically.

To obtain proper relaxation for adequate palpation of the neck the following positions of the head should be utilized (Fig. 23). The anterior triangle of the neck is relaxed if the occiput is pushed forward so that the patient's head is flexed. The posterior triangle of the neck can be felt properly if the patient's head is inclined toward the side that is being examined. The submental region is examined best with the head flexed slightly in the neutral position.

The supraclavicular regions must be palpated carefully in every case. The pulsations of the third portion of the subclavian artery are felt in an angle formed by the clavicle and the posterior border of the sternocleidomastoid. The back of the neck can be relaxed when the patient's head is partially extended.

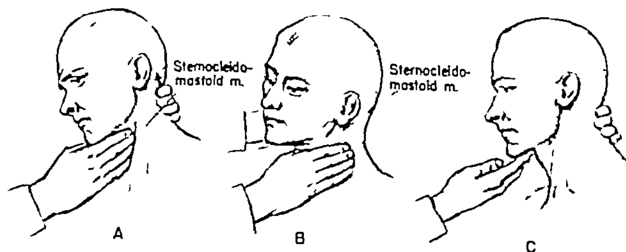


Fig. 23. Palpation of the neck. (A) The anterior triangle of the neck is relaxed if the occiput is pushed forward. (B) The posterior triangle of the neck is felt best if the patient's head is inclined toward the side that is being examined. (C) The submental region should be examined with the head slightly flexed.

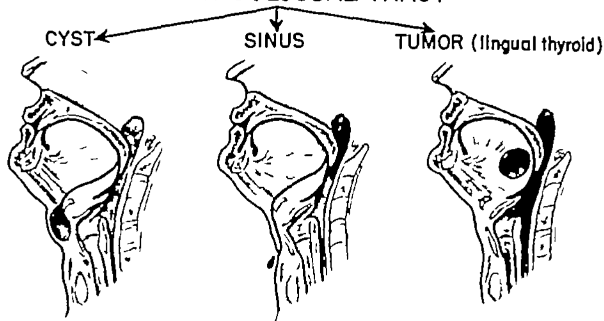


Fig. 24 Anomalies of the thyroglossal tract. Developmental defects affecting this tract may result in a cyst, a sinus or a lingual thyroid.

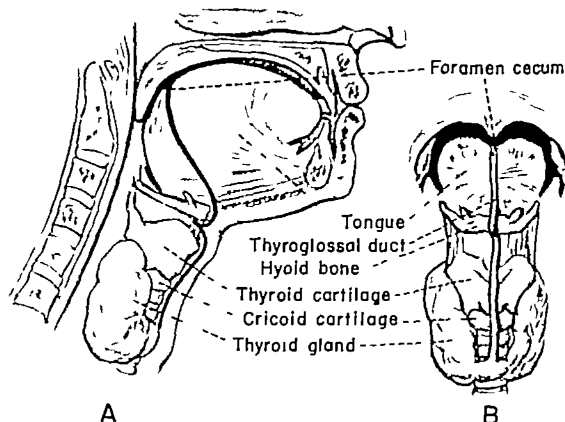


Fig 25 The thyroglossal tract originates at the posterior aspect of the tongue (foramen cecum) extends downward and ends as the thyroid gland.

CONGENITAL DEFECTS

The more important congenital lesions are thyroglossal duct cysts branchiogenic cysts and sinuses, and cystic hygromas

THYROGLOSSAL TRACT CONDITIONS

Anomalies of the thyroglossal duct arise from a congenital persistence of this tract They may be divided conveniently into 3 conditions (1) thyroglossal cysts (2) thyroglossal sinuses and (3) thyroglossal tumors (lingual thyroid) (Fig 24)

The thyroglossal tract originates at the foramen cecum which is located at the posterior third of the tongue (Fig 25) From this site a solid column of cells grows downward in the fetus this column becomes canalized and forms the thyroglossal duct, from which the thyroid gland develops The three listed anomalies occur along this tract

Thyroglossal Cysts

These occur in the *mid-line* of the neck and usually during childhood Recurrent inflammatory bouts result in disfigurements They may appear between the submental area and the suprasternal notch but are found most commonly near the hyoid bone The cyst may be tiny or as large as a golf ball If no inflammation is present it is smooth round and displaceable although it is anchored to the deeper tissues and the hyoid bone It is not attached to the skin nor is it tender unless inflamed These cysts move with swallowing and also with protrusion of the tongue (Fig 26) They represent the most common swelling in the mid line of the neck

Dermoids lipomas and sebaceous cysts can occur also in the mid line of the neck

Thyroglossal Sinuses

These sinuses result from spontaneous perforation of or surgical incision into a thyroglossal cyst When inflammation or abscess formation is present redness pain and heat are noted Their *mid-line* position is the most diagnostic feature

Thyroglossal Tumor

These constitute the so-called lingual thyroids they are rare They usually repre

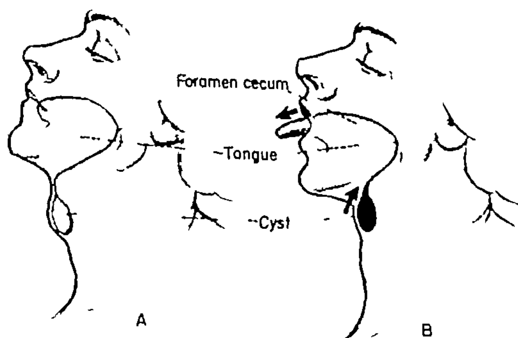


FIG 26 Thyroglossal cyst These cysts move with swallowing and with protrusion of the tongue

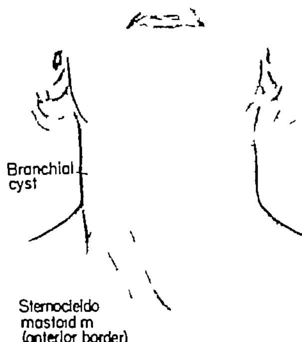


FIG 27 Branchial cyst. These cysts are congenital and always appear along the anterior border of the sternocleidomastoid muscle.

sent the total thyroid tissue that the patient possesses If they are removed they may produce surgical myxedema. Since they are located between the back part of the tongue and the hyoid bone they resemble thyroglossal cysts This differential diagnosis is most difficult. It is perferable to explore them rather than to aspirate them they should be biopsied before removal is commenced.

Differential diagnosis of thyroglossal tract anomalies includes branchiogenic cysts lymphadenitis tuberculous lesions mid line cervical clefts and specific granulomas

Branchial Cysts and Fistulas

Branchial cysts are congenital. They appear in the anterior triangle of the neck. They may be found anywhere along the *anterior border* of the sternocleidomastoid muscle The usual site is the middle third of that muscle (Fig 27) They may be unilateral or bilateral.

The complaint is one of a mass in the neck not associated with pain As a rule the diagnosis is easy but these may be mistaken for tuberculous adenitis cystic hygroma, carotid body tumor, metastatic glands and thyroid adenomas Thyroglossal cysts should cause no diagnostic difficulty since they lie in the mid line of the neck At times it may be necessary to aspirate the cyst such fluid reveals the typical cholesterol crystals

Branchial fistulas appear as small dimples or tiny openings closely associated with the *anterior border* of the sternocleidomastoid muscle The fistula may be complete or incomplete depending upon whether or not there is an internal opening that extends into the pharynx (Fig 28) This can be elicited readily by the injection of a radiopaque material into the external opening The external opening is situated along the lower third of the *anterior* border of the sternocleidomastoid muscle If the fistula is complete it dips between the external and the internal carotid arteries before entering the pharynx. A discharge of mucoid material is commonly present. Secondary infection is a frequent complication. When this occurs the discharge becomes purulent, and signs of inflammation are present. A draining tuberculous sinus may be confused



FIG 28 Roentgenogram of an injected branchial fistula. The external opening is located at the *anterior* border of the sternocleidomastoid muscle, and the internal opening extends into the pharynx.

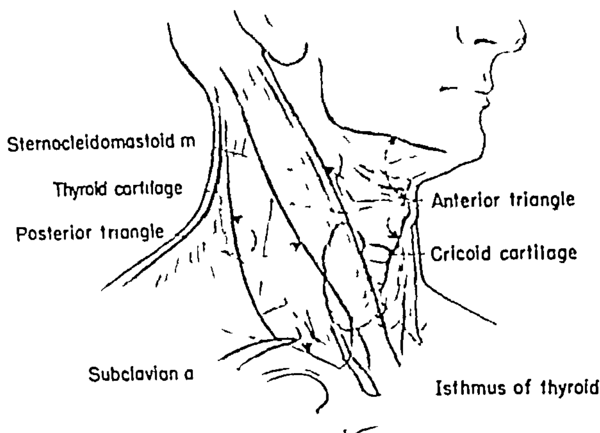


Fig 29 The normal thyroid gland extends from the middle of the thyroid cartilage to the fourth or the fifth tracheal ring. The isthmus usually crosses the third tracheal ring

with a branchial fistula Tuberculosis is suggested by the presence of multiple cutaneous openings and palpable enlarged lymph glands Other specific granulomas must be differentiated also

Cystic Hygroma

This is a rather uncommon lateral cervical swelling which usually is seen in infants or young children Typically it is found in the lower third of the neck and enlarges as it extends upward toward the ear If it extends downward it can pass behind the clavicle to the dome of the pleura It may extend into the axilla also It feels soft and irregular and usually is located *behind* the sternocleidomastoid muscle Pain or local discomfort usually are absent unless secondary infection has occurred Since it lies in a superficial plane it tends to bulge outward and rarely produces pressure symptoms upon the cervical viscera If it is large it may interfere with movements of the head Occasionally it ruptures spontaneously and disappears

THYROID GLAND

The normal thyroid is palpable in slender individuals but cannot be felt in thick necked or obese people Each lobe normally extends from the middle of the thyroid cartilage to the fourth or the fifth tracheal ring The isthmus which is usually but not always present, connects both lobes and passes across the third tracheal ring (Fig 29)

The size of the gland is not related to its toxicity

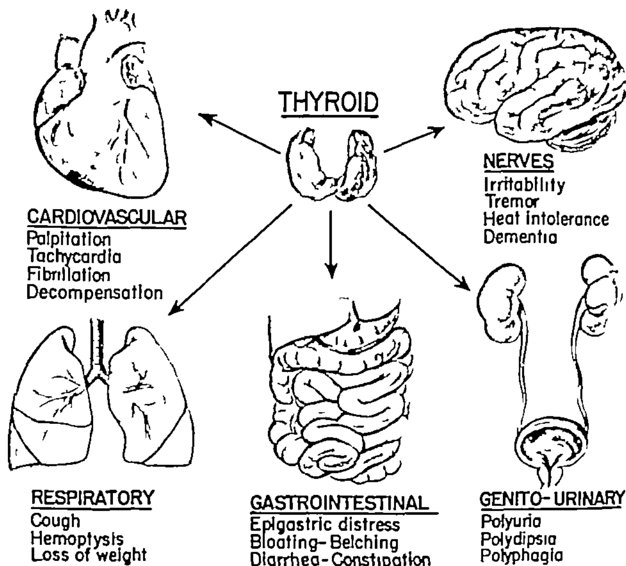


Fig 30 Hyperthyroidism. This great masquerader can involve any of the 5 major systems. When cardiovascular complaints are foremost, the case may be mistaken for organic heart disease. Respiratory symptoms suggest tuberculosis. The gastrointestinal symptoms may lead to erroneous diagnoses which involve the gallbladder, the stomach or the bowel Involvement of the nervous system focuses attention on psychiatric conditions. Unfortunately the hyperthyroid patient may be mistaken for a diabetic when polydipsia polyuria and polyphagia constitute the primary complaints

A useful *clinical classification of the thyroid state* is the following

Toxic Goiter

A. Diffuse
B Adenoma (Nodose)

Nontoxic Goiter

A. Diffuse
B Adenoma (Nodose)

Hyperthyroidism

Hyperthyroidism resembles two other great masqueraders namely tuberculosis and syphilis since they affect any or all of the major systems (Fig 30) The 5 major systems are the cardiovascular, the respiratory the gastro-intestinal, the genito-urinary and the nervous

The cardiovascular symptoms make the

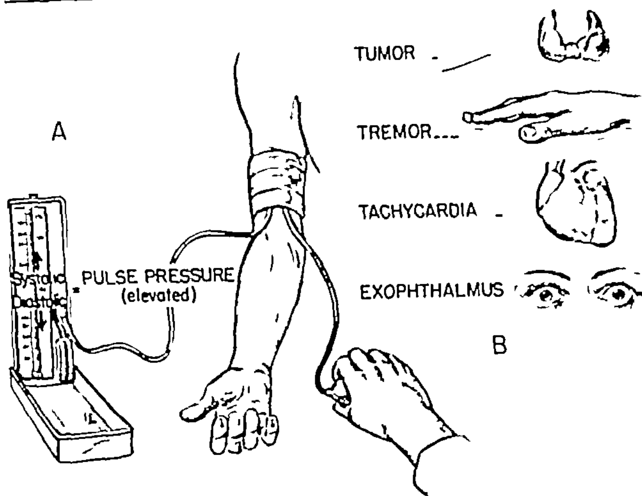


Fig 31 Hyperthyroidism (A) The blood pressure is characteristic, since the systolic is elevated the diastolic somewhat lower and the pulse pressure increased (B) The cardinal signs of hyperthyroidism

patient heart conscious He seeks medical aid because of his "heart trouble" This results from such symptoms as palpitation, tachycardia dyspnea or decompensation Lahey has aptly referred to these patients as thyrocardiacs" Should decompensation take place the unseasoned clinician is misled by the orthopnea ascites and dependent edema. Paroxysmal auricular fibrillation when present should make one suspicious of a toxic thyroid

The respiratory symptoms such as cough loss of weight and blood streaked sputum might suggest tuberculosis It is well to remember that the patient with hyperthyroidism has a ravenous appetite but the tuberculous individual is finicky about his food Determination of the blood pressure is a simple and excellent way of differentiating tuberculosis from hyperthyroidism The hyperthyroid patient has a somewhat elevated systolic and a normal or lowered diastolic pressure This results in the almost pathognomonic elevated pulse pressure of the toxic thyroid (Fig 31 A) The tuberculous patient does not reveal this characteristic change

The gastro-intestinal symptoms of the hyperthyroid patients are numerous and bizarre. Among these are alternating diarrhea and constipation bloating distention and vague abdominal pains usually these are associated with extreme weakness The appetite is excellent but with impending thyroid crises anorexia nausea or even vomiting may be present With such gastro-

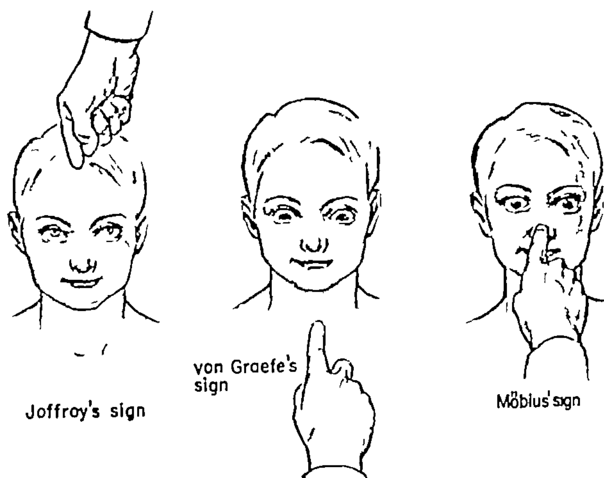


FIG 32 Eye signs associated with hyperthyroidism.

intestinal complaints carcinoma gallbladder disease, ulcer and enterocolitis must be ruled out.

The genito-urinary system may be involved also and diabetes mellitus may be diagnosed erroneously because these patients present the diabetic triad namely polydipsia polyphagia and polyuria Since these patients consume large quantities of carbohydrates and sugars they frequently have an alimentary glycosuria This is differentiated readily if the fasting blood sugar is determined

Nervous symptoms vary from irritability to dementia.

Heat intolerance is usually present such individuals are the first to open the windows to turn down the heat and to use few or no covers despite a very cool room. Most of them sweat excessively

Physical examination should determine the size and the consistency of the thyroid gland This gland moves with swallowing and hence should not be confused with other masses The cardinal signs of hyperthyroidism have been listed as tumor tremor tachycardia and exophthalmus (Fig 31 B)

TREMOR. A tremor is usually present it may be quite fine and easily overlooked To demonstrate such tremors the patient should be asked to spread his fingers as the physician places a piece of paper over them, the movements of the paper are readily seen

EYE SIGNS At times eye signs are present and helpful as diagnostic aids (Fig 32)

Exophthalmos may or may not be present. It is usually bilateral.

Lid lag (Von Graefe's sign) is positive when the upper lid lags behind the lower lid as the patient looks down; this exposes the white eyeball.

Failure of convergence (Mobius sign) is positive when one or both eyes fail to converge on an object which is brought close to the mid line of the face.

Retraction of the upper lid (Stellwag's sign) is often associated with spasmodic contractions of the lid as the patient looks upward.

Failure to wrinkle the forehead when the patient suddenly turns his eyes upward is Joffroy's sign.

Thrill and Bruit. A palpable thrill and an audible bruit are sometimes present in the more advanced cases.

Dermographia is readily demonstrable in hyperthyroidism; it is a manifestation of vasomotor instability.

The use of Lugol's solution as a therapeutic test is helpful. 10 drops 3 times a day should produce vast improvement and diminish most of the symptoms. Then the solution should be utilized only as a preparatory measure for surgery.

Tumor. Palpation gives valuable information in that the size and the consistency of a nodule can be detected readily. As was stated previously, all thyroid tissue and masses move with swallowing. The lower pole can be felt if the sternocleidomastoid muscle is pushed aside. If one fails to feel this lobe, a retrosternal thyroid should be suspected. Percussion over the manubrium reveals a specific dullness which is most suggestive of a retrosternal mass. It is important to detect solitary nodules in the thyroid gland, particularly the nontoxic variety. Statistical data suggest that malignancy is fairly common in such nodules; figures varying from 5 to 20 per cent have been reported.

As stated, the size of the gland is not related to the degree of toxicity. Marked enlargements encroach upon the trachea, displace it and produce dyspnea. Pressure on the esophagus produces dysphagia. Such displaced viscera can be demonstrated readily by the roentgenogram (Fig. 33).

Laboratory Tests. Some *laboratory tests* are helpful in the diagnosis of hyperthyroidism.

The *basal metabolic rate* is a most reliable test. In hyperthyroidism the rate is

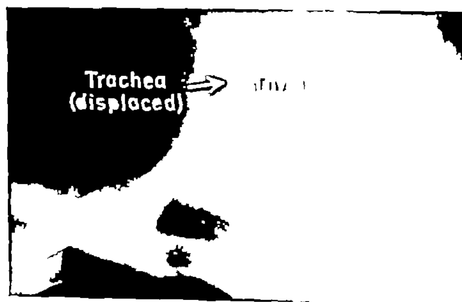


Fig. 33. Roentgenogram revealing displacement of the trachea and the esophagus by an enlarged thyroid.

elevated however, it must be recalled that no tests are foolproof and other conditions might produce elevated basal metabolic readings Leukemia, febrile states and pheochromocytoma to mention only a few produce increased readings

The *blood cholesterol* is usually normal or below normal (140 to 200 mg %) in hyperthyroid states

The *serum protein bound iodine (P.B.I.)* is elevated in hyperthyroidism In most clinics levels above 7.5 micrograms per 100 cc. are considered as diagnostic of this condition Iodine containing medicaments or tests (cholecystography) make the test *valueless*

Radioactive iodine has been used for tracer studies and usually reveals an increased concentration and retention of the isotope in the thyroid or a decreased excretion of the tracer

Some observers still associate with the hyperthyroid state a relative to absolute lymphocytosis with a normal to slightly depressed total white count

Hypothyroidism

This condition produces a clinical picture that is the opposite of hyperthyroidism. Hypothyroidism is characterized by a diminution of practically all the vital processes this results from an insufficiency or an absence of thyroid substance Clinically it is manifested by a slowing of the metabolism No primary cause for the disease has been discovered except myxedema, which results from excessive removal of the thyroid gland Nonoperative myxedema may be congenital (cretinism) or may occur in infancy or adulthood The lists at the bottom of this page reveal the main differences between hyperthyroidism and hypothyroidism

Thyroiditis

The thyroid gland may be involved in inflammatory conditions These are usually present in one of three types acute thyroiditis, Hashimoto s thyroiditis or Riedel s chronic thyroiditis (Fig 34)

Acute thyroiditis is a nonspecific con-

Hyperthyroidism and Hypothyroidism Compared

Hyperthyroidism	Hypothyroidism
1 Accelerated metabolism	1 Low metabolism
2 Frequent accelerated pulse often irregular	2 Slow, small, regular pulse
3 Anxious expression	3 Apathetic, quiet appearance
4 Vasomotor instability	4 Vasomotor stability
5 Wide lid slits	5 Narrow lid slits
6 Appetite usually ravenous	6 Normal appetite or anorexia
7 Vascular and moist skin	7 Thick wrinkled, dry skin
8 Long slender fingers	8 Short thick fingers
9 Hypersensitiveness	9 Dulled sensation
10 Insomnia and restless sleep	10 Drowsiness and sound sleep
11 Mental excitations mania or melancholia	11 Apathy
12 Feeling of heat	12 Feeling of cold
13 Loss of weight emaciation	13 Increase of body weight, obesity
14 B.M.R elevated	14 B.M.R. low

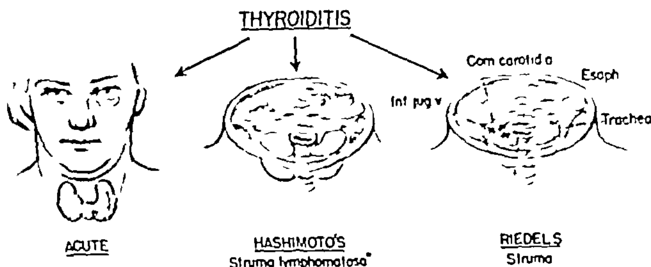


Fig 34 Thyroiditis Three types of inflammatory conditions which may involve the thyroid gland are acute thyroiditis Hashimoto's struma and Riedel's struma Acute thyroiditis is a nonspecific condition caused by streptococci and/or staphylococci Hashimoto's struma does not attach itself to surrounding structures and the symptoms associated with it are mild Riedel's struma extends into adjacent structures These conditions must be differentiated from carcinoma

dition usually caused by a staphylococcic or streptococcic infection It is associated most frequently with an acute upper respiratory infection but may also appear as part of the clinical picture of a generalized septicemia It is characterized by pain in the region of the thyroid gland which radiates to the neck the head and particularly the ear The gland is tender and the patient complains of distress when swallowing or with movements of the head The usual signs of inflammation redness swelling and induration are present they are associated with spasm of the 'strap" muscles which forces the patient to hold the head in flexion Dysphagia, dyspnea hoarseness or aphonia may be present A characteristic laboratory triad consists of an increased sedimentation rate a high concentration of protein bound plasma iodine, and a low uptake of radioiodine by the thyroid gland The serious complications are abscess formation perforation into the trachea and/or extension of the infection into the mediastinum The disease may respond to chemotherapy subside in its acute phase or become chronic.

Hashimoto's struma almost always occurs in females It uniformly involves the entire gland and presents a smooth surface which does not attach to surrounding structures It is characterized microscopically by a marked lymphoid overgrowth and has been referred to as struma lymphomatosa." The symptoms are usually mild but if a subtotal thyroidectomy is performed hypothyroidism may result

Riedel's struma is characterized by excessive fibrosis This usually starts in one lobe and eventually extends to the entire gland As a rule the gland is not increased in size but feels extremely hard the outlines of the gland may be lost because of direct extension into adjacent structures Females are affected more frequently than males, and the condition usually occurs after the age of 40 Dyspnea and dysphagia may be present and if the sclerosing process involves the jugular veins an edema of the face and the neck occurs In the early stages

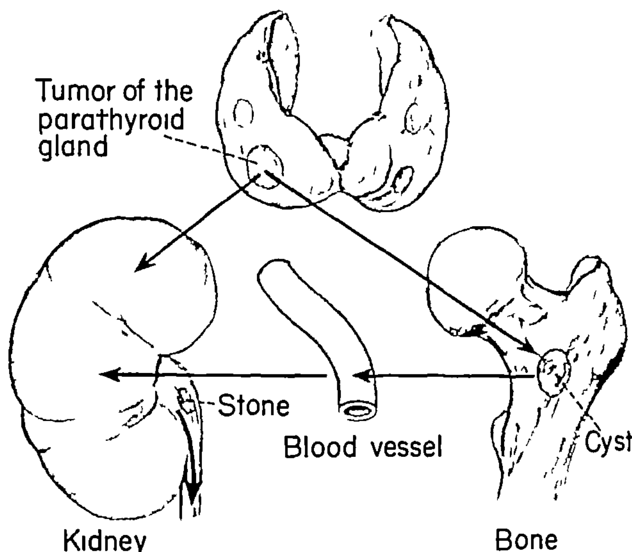


FIG 35 Hyperparathyroidism. The overproduction of parathormone results in the formation of kidney stones (nephrocalcinosis) and the development of bone cysts —osteitis fibrosa cystica (von Recklinghausen s disease)

hyperthyroidism may be present, but as the condition progresses a hypofunction of the gland becomes evident

It is incumbent upon the physician to keep these conditions in mind and to differentiate them from carcinoma of the thyroid This can be done only by a microscopic examination

Carcinoma of the thyroid must be suspected when any nodularity or firmness of the gland is present A solitary nodule may be the only manifestation of early malignancy and since the differential diagnosis between a benign cyst, a benign adenoma and Riedel s or Hashimoto s strumas is extremely difficult the responsibility placed upon the physician is great Any firmness in the gland must be considered cancer until proved to be otherwise this can be accomplished only by biopsy Advanced cancer is characterized by stony hardness, irregular nodularity and fixation to the underlying tissues The obstructive symptoms and hoarseness associated with chronic thyroiditis may be present in carcinoma also

Lateral aberrant thyroid tumors are small relatively slow-growing carcinomas. These are usually of the papillary type and may spread to the cervical glands before there is any detectable mass in the thyroid

gland Since the involved glands histologically resemble normal thyroid tissue the term lateral aberrant thyroid tumors has been used These lateral thyroid masses are found close to the internal jugular vein and the deep chain of cervical lymph nodes Such masses must not be confused with specific or non specific lymphadenitis or lymphomas (p 37)

PARATHYROID GLANDS

The parathyroid bodies or glands are small structures usually 4 in number which are located along the posterior aspect of the thyroid gland Their most important function is associated with calcium metabolism The two most common conditions to which they are related are hyperparathyroidism and hypoparathyroidism (tetany)

Hyperparathyroidism may be produced by a parathyroid tumor or a generalized hyperplasia In either event the active principle of the gland parathormone is produced excessively Such excess production of the hormone results in at least 2 major physiologic effects (Fig 35) The first is that of decreasing the reabsorption of phosphate by the renal tubules which results in phosphate diuresis The second effect acts directly upon the osteoclasts and brings about a demineralization of bone The total effect is a marked increase in the amount of phosphate lost from the body through the kidneys and a lowering of the serum inorganic phosphorus level In an attempt to compensate for this loss calcium and phosphorus are mobilized from bone (decalcification) The excess calcium and phosphate precipitate in the kidney (nephrocalcinosis) form stones and damage the organ

The diagnosis of hyperparathyroidism is simple when the condition is fully developed Decalcification of the bony skeleton appears as severe cystic changes a condition known as osteitis fibrosa cystica (von Recklinghausen s disease) Complete bony decalcification is demonstrated readily on

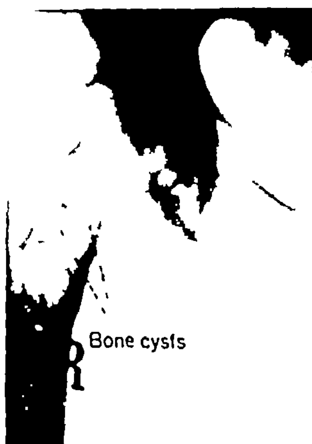


Fig 36 Roentgenogram of bone cysts (osteitis fibrosa cystica) in a case of parathyroid adenoma

the roentgenogram (Fig 36) Sequelae include spontaneous fractures collapse of vertebral bodies rounding of the back, and the nerve root pains Such changes are usually irreversible Any patient with a rounding of the back and/or evidence of decalcification of the skeleton should be suspected of having hyperparathyroidism The same may be said for any patient with a history of kidney stones, or renal or ureteral colic The earlier cases are more difficult to diagnose since they present such vague symptoms as muscular weakness pains in the extremities and the back, polyuria and polydipsia Lassitude, undue fatigue and constipation are symptoms which usually are overlooked

Rarely is a parathyroid tumor palpable

If one suspects parathyroid overactivity the laboratory tests will usually reveal conclusive evidence Typical findings consist

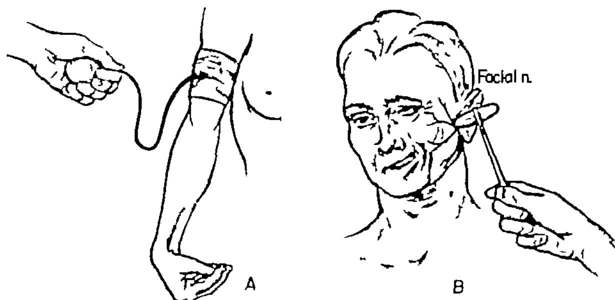


FIG 37 Tetany (A) Trousseau s sign a blood pressure cuff is placed around the arm and the pressure is raised to 200 mm Hg If tetany is present, the typical muscular spasm of the hand (obstetrician's hand) appears within 5 minutes. (B) Chvostek s sign Tapping the facial nerve lightly produces spasms of the irritable facial muscles.

of an elevation of serum calcium from the normal of 10 to a level varying from 12 to 20 or more milligrams per 100 cc. of serum —a depression of serum phosphorus from a normal of 4 to 1 5 to 3 5 mg per 100 cc. The plasma alkaline phosphatase which is dependent largely upon the amount of bone change may be elevated from the normal 2 to 4 Bodansky units to 30 or 40

Localized bone defects noted on the roentgenogram are usually found in the long bones and/or the mandible They appear in one of two forms either bone cysts or benign giant cell tumors (osteoclastomas)

Hypoparathyroidism (tetany) is observed most commonly following a thyroidectomy where inadvertently the parathyroid glands have been removed or injured The condition is manifested within 24 or 48 hours after operation however it might appear some weeks later Headache restlessness tachycardia irritability and twitching of the muscles particularly those of the *upper extremities comprise the usual signs* and symptoms The serum calcium level is lowered Most diagnostic are the typical carpopedal spasm which consist of flexion at the metacarpophalangeal joints with abduction of the thumb similar contractions of the feet are noted The muscular spasm of the hand can be induced by pressure which interferes with the blood supply to the nerves this can be produced by a tourniquet (Trousseau s sign) (Fig 37 A) Irritability of the muscles *may be so pro*nounced that gentle tapping over a nerve may instigate a spasm this is readily demonstrated when the facial nerve is tapped lightly (Chvostek s sign) (Fig 37 B) Occasionally spasm of the laryngeal muscles produce respiratory difficulty

There are types of tetany which are not associated with the parathyroid glands. For example the tetany from avitaminosis, particularly vitamin D results in failure to absorb and retain adequate amounts of calcium. Another form of tetany results from alkalosis induced by overbreathing So-called *gastric tetany* is caused by a depletion of hydrochloric acid produced by per

sistent vomiting it is a manifestation of alkalosis

CERVICAL LYMPH NODE DISEASES

Cervical lymph node enlargements are evidence of some pathologic process, either past or present this is particularly true in the adult Investigation must be instituted when such enlargements are present

The enlargements can be discussed conveniently under the following headings local inflammatory conditions chronic infections metastatic lesions and primary malignant lymphoid tumors

Local Inflammatory Conditions

These conditions are responses to pyogenic infections The *preauricular nodes* drain the temporal region of the scalp, the eyelids and the cheek The *postauricular nodes* drain the scalp (parietal portion) and the region in back of the ear The *sternocleidomastoid nodes* are found along the posterior edge of the sternocleidomastoid muscle and drain the nasopharyngeal and the adenoid areas The *submaxillary nodes* are located beneath the mandible and drain the floor of the mouth the anterior portion of the tongue the gums the lips and the lower portion of the face The *submental glands* drain the lower lip the tip of the tongue and the anterior part of the mouth The *internal jugular nodes* are found along the internal jugular vein beneath the sternocleidomastoid muscle and drain the superficial glands which in turn drain the tongue the mouth and the pharynx. The *tonsillar glands* are frequently involved they occur near the angle of the jaw The *supraclavicular nodes* receive lymph from the back of the scalp and the neck the upper chest wall the upper axillary region parts of the breast the lowest cervical nodes and portions of the lung they connect with the thoracic duct If the primary infection is a minor one this leads to moderate enlargement and tenderness of the involved glands but should the infection be grave the glands may break down and form abscesses The usual signs of inflammation namely tenderness redness and heat, are found in the overlying skin Systemic manifestations are also present

Chronic Infections

Chronic lymphadenitis occurs frequently as a result of chronic or recurrent mild pyogenic infections of low grade virulence A common example is repeated chronic upper respiratory infections with cervical lymphadenopathy Chronic lymphadenitis may be associated with a specific granulomatous disease such as tuberculosis syphilis, actinomycosis and chronic brucellosis

Metastatic Lesions

Metastatic tumor tissue carcinoma and sarcoma, may involve the cervical lymph nodes when the primary source arises in the area drained by these glands Superimposed inflammation may be present and obscure the underlying malignancy

Primary Malignant Lymphoid Tumors of the Neck

These tumors constitute a most important group There are many classifications of such tumors It has been found advantageous to classify them according to the cells from which they are derived These lymphoid tumors represent the neoplastic overgrowths of the various cells that make up a normal lymph node When we recall the structural arrangement of a normal lymph follicle we note the reticular cell in the center a second zone of lymphoblasts and a third or outside zone of mature lymphocytes (Fig 38)

Macrofollicular lymphoma (Brill Symmers disease) is a manifestation of abnormal growth that originates in the lymphocyte layer This is the most benign of all the lymphomas, it may take many years before the malignant nature of this disease

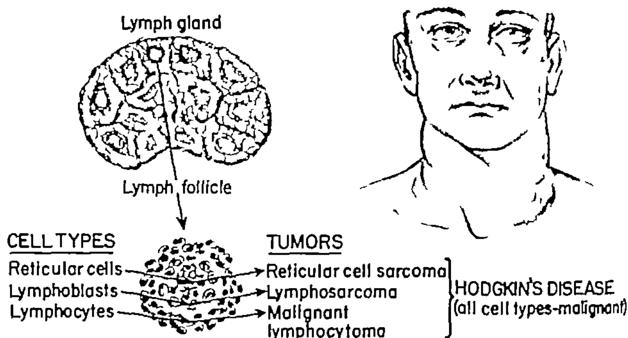


FIG 38 The lymphoblastomas This simple plan aids in understanding the terminology and the classification of these conditions. The predominant cell type determines the nature of a specific tumor and the name by which it is designated.

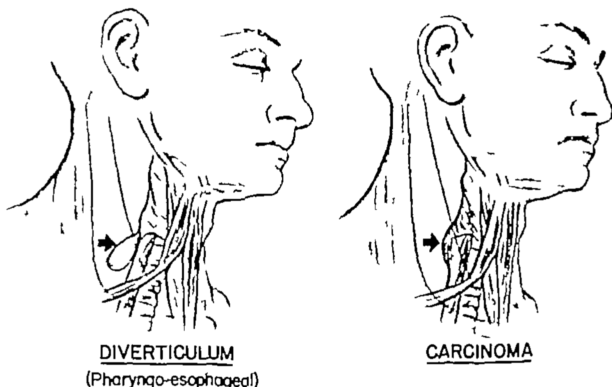


FIG 39 The cervical portion of the esophagus. Pharyngo-esophageal diverticula and carcinoma affect this part of the organ Frequently, a carefully elicited history can differentiate the two

is manifested Terminally it can change its histologic picture to any one of the other forms

Malignant lymphocytoma has been referred to as small cell lymphosarcoma This condition also originates from the layer which compromised the mature lymphocyte (the peripheral layer) The differentiation between this condition and chronic lymphatic leukemia is extremely difficult some authorities are of the opinion that they are one and the same condition

Lymphosarcoma also called large cell lymphosarcoma originates from the lymphoblast layer Microscopically there is a complete replacement of the architecture of the lymph nodes and mitotic figures are numerous *Reticulum cell sarcoma* has been called stem cell sarcoma, since it originates in the innermost layer where the reticular cells are found Occasionally an anaplastic carcinoma or melanoma may simulate reticulum cell sarcoma

Hodgkin s disease (Hodgkin s sarcoma) is a malignant manifestation in which all of the cell types of the lymph node have undergone malignant changes

Overlapping of the conditions is frequent and one form blends with another At times two different histologic pictures appear in the same node

Mid line cervical lymphoid tumors are extremely rare, since the nodes are located in the lateral aspects of the neck

Biopsy is essential but it is well to remember that frozen sections are difficult to study It is preferable to await a study of the permanent fixed sections

PHARYNX CERVICAL ESOPHAGUS AND LARYNX

Although the esophagus is heir to many diseases, the two which are found most frequently in the cervical portion are pharyngoesophageal diverticula and carcinoma (Fig 39)

Pharyngo-esophageal Diverticulum

This condition has also been referred to as Zenker s diverticulum It occurs at the weakest point which is located at the lower border of the inferior constrictor muscle (pharyngo-esophageal junction) These diverticula result from a herniation of mucosa through the muscularis (pulsion) The earliest symptom may be a mild dysphagia or a choking or coughing spell which occurs during eating and may pass unnoticed at first Repeated clearing of the throat particularly when associated with increased salivation are notably significant Changing the position of the head may affect the ease or the difficulty of swallowing Also of importance

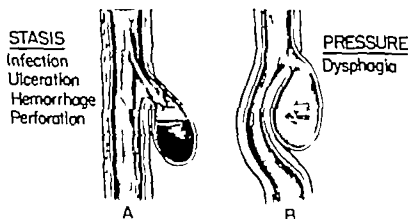


Fig 40 Symptoms from esophageal diverticula are due to stasis or pressure (A) Stasis results in the complications listed (B) Pressure is associated with dysphagia



FIG 41 Roentgenogram of a pharyngo-esophageal diverticulum. Note the pressure on and displacement of the esophagus.

is the fact that difficulty in swallowing fluids is noticed first this is the reverse of the story related by a patient with a tumor As the pouch develops retrosternal pain is experienced and the patient complains of an actual sense of pressure in the neck particularly during mealtime Regurgitation of food is usually present and may be demonstrated by direct pressure upon the diverticulum The regurgitated material contains food taken at an earlier meal Should *stasis* develop infection and its train of complication — ulceration hemorrhage perforation and mediastinitis — may result (Fig 40 A) Other symptoms result from pressure (Fig 40 B) marked dysphagia dyspnea, and alteration in voice are common examples Death may result from aspiration of retained material into the tracheobronchial tree. The physical examination is usually noncontributory unless the pouch is of tremendous size The diagnosis is confirmed by the roentgenogram and at times by esophagoscopy (Fig 41) The latter method may result in trauma and perforation.

Carcinoma of the Esophagus

This lesion is usually epidermoid or squamous cell in nature The onset and the progress of symptoms follow a definite pattern. Dysphagia is the first symptom and is associated with difficulty in swallowing solid foods This becomes progressively worse the patient finds it easier to swallow soft foods and finally liquids There may be periods of intermittency during which time the patient might be misled and concludes that his difficulty has passed In a short time, however the dysphagia reappears and progresses Relief from symptoms is explained by the fact that the central portion of the tumor may ulcerate, this partially restores the lumen A feeling of vague discomfort rather than actual pain in the chest is usually present. This may be a substernal burning or a steady boring ache felt deep within the chest Radiation of pain into the neck or the interscapular region is frequent. The patient usually points to the exact level at which the lesion is located Signs of dehydration and loss of weight become apparent and suggest a far-advanced lesion. Physical signs are minimal or absent The roentgen examination and biopsy determine the exact nature of the lesion

Differential diagnosis includes diverticula stricture coronary disease foreign bodies extrinsic pressure benign tumors thyroid enlargements, globus hystericus, esophagospasm, retropharyngeal abscess, Plummer Vinson syndrome and specific granulomatous diseases. Although the disease predominates in males it is interesting to note that cancer of the cervical esophagus occurs more frequently in females.

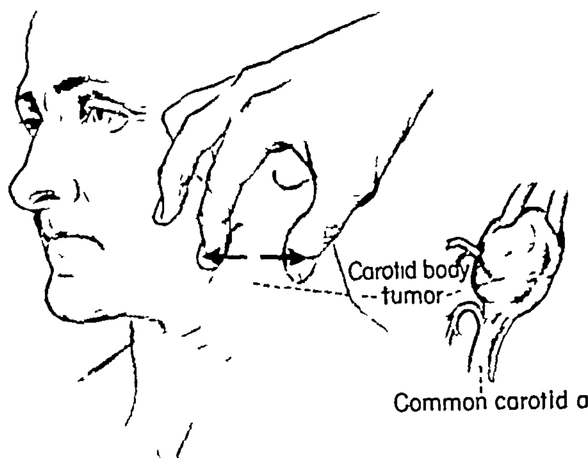


FIG 42 A carotid body tumor can be moved in a horizontal but not in a vertical direction

LARYNGEAL CANCER

This lesion is predominately a disease of the adult male nearly all of the patients being over 40 years of age Although it occasionally develops in the nonsmoker, 80 per cent of the cases occur in smokers The first symptom of laryngeal carcinoma is hoarseness or alteration of the voice A desire to clear the throat or a constant feeling of something in the throat are early complaints that cannot be overlooked The author has stressed continually the importance of the phrase change in habit a change in "voice habit' is usually the earliest symptom of laryngeal carcinoma Other symptoms are pain in the throat or pain referred to the ear hemoptysis or the presence of a mass The visual examination of the larynx with the laryngeal mirror is quite satisfactory and can be conducted quickly and easily A few cases require direct laryngoscopy and pharyngoscopy to visualize the postcricoid area The diagnosis is established from microscopic study of the biopsy

CAROTID BODY TUMORS

Tumors of the carotid body are relatively uncommon They are serious because they may encircle the carotid arteries or may become malignant. Their origin is still moot Whether or not they are associated with the sympathetic nervous system is still a debatable point As a result of the confused origin, the nomenclature also has be-

come confused The term "carotid body tumor" is probably the best

The function of the carotid bodies is debatable as to whether or not they are chemoreceptors, it is believed that they are sensitive to changes in hydrogen ion concentration *Most authorities are of the opinion* that they do not secrete epinephrine They are paired structures which are situated near the bifurcation of the carotid artery The average size is 5 mm in diameter and they have a reddish brown or gray color

Tumors of the carotid body are usually unilateral but may be bilateral they may project into the pharynx. Essentially they are asymptomatic slow growing masses. Such symptoms as pain in the face and the neck, hoarseness and dysphagia may be present, however it is the presence of the mass that is noticed first. Occasionally a thrill and/or bruit are detected At times the hypoglossal nerve and the recurrent laryngeal nerve may be involved

Since they are located in the carotid notch and appear along the anterior border of the sternocleidomastoid muscle they may be confused with branchial cysts. In differentiating this tumor from other masses in the neck it should be recalled that because of its location in the fork of the carotid notch and its close association with the carotid vessels the mass may be moved from side to side but not in a vertical direction (Fig 42) It can be differentiated

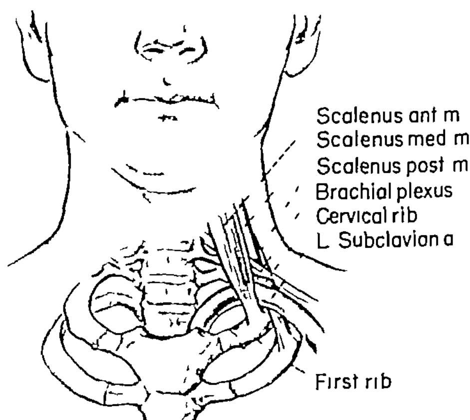


Fig 43 The scalenus anticus syndrome. An anatomic vice is formed by the scalenus anticus muscle anteriorly and the scalenus medius posteriorly A cervical rib a vertebrocostal ligament or the scalenus minimus muscle may be present and add to the compression upon the neurovascular bundle posteriorly

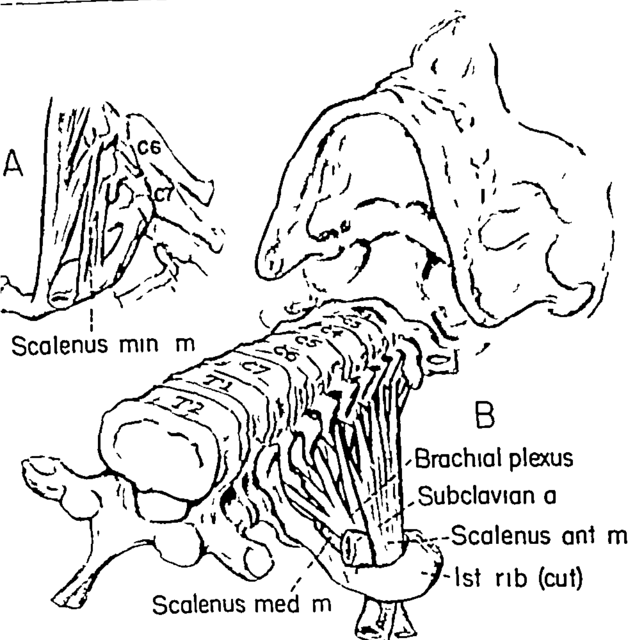


FIG. 44 The scalenus "vice seen from below

from thyroid masses because it does not move when the patient swallows

It is the consensus that the incidence of malignancy is lower than is generally thought Most authorities consider them low-grade malignant lesions with potentialities toward invasion and metastases Indiscriminate removal of such tumors particularly when this requires division of the carotid vessels, is not justifiable unless definite malignant degeneration has been suspected or is established

SCALENUS ANTICUS SYNDROME

The so-called scalenus anticus syndrome is a brachial plexus neuritis caused by chronic pressure The pain associated with the condition may be very disabling Equally important is pressure on the subclavian artery which results in such circulatory changes as fingernail and local skin atrophy with destruction of the digits particularly the third and the fourth (Figs 43, 44) The anatomic configuration and the re-

Fig 45 Vascular compression test (Adson) Note that the patient's chin is elevated toward the *affected* side. If the radial pulse is altered or obliterated the test is considered positive and indicates a scalenus anticus syndrome

lationship of the scalenus anticus muscle anteriorly to the first rib and the scalenus medius posteriorly explains the physiopathology An anatomic vice is formed which compresses the neurovascular bundle If a scalenus minimus muscle is present it further adds to the compression effect In some individuals fibrous bands replace the minimus muscle such bands are referred to as the vertebrocostal ligament. A cervical rib may or may not be associated with the scalenus anticus syndrome

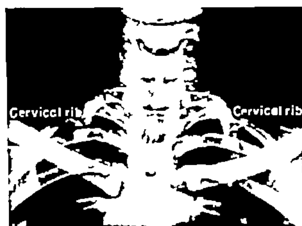


Fig 46 Roentgenographic demonstration of bilateral cervical ribs.

The vascular compression test of Adson is significant when positive. The test is conducted in the following way (Fig 45) the patient is seated takes a deep breath, holds it and turns his chin up and to the *affected side* An alteration or obliteration of the radial pulse on that side or a change in blood pressure indicates that the subclavian artery is compressed. The test is not pathognomonic since it may also be caused by reflex sympathetic stimulation in the presence of a cervical arthritis Digital pressure over the insertion of the scalenus anticus muscle will intensify the symptoms when the syndrome is present. Thorough roentgenographic study of the cervical spine should be made for the purpose of ascertaining the presence or the absence of

cervical ribs or cervical arthritic spurs (Fig 46) If a cervical rib is present it may be necessary to excise it In the absence of bony projections or cervical ribs the procedure which produces most gratifying results is the surgical division of the scalenus anticus muscle at its insertion into the first rib

Cervical lipomas are frequent they may be above or below the deep cervical fascia The so-called *hibernoma* is under the fascia and appears in the posterior cervical triangle Supposedly it is related to that fat which is found in hibernating animals Other tumors that may appear are osteomas neurogenic chondromas and hemangiomas Aneurysms of the carotid artery and arteriovenous aneurysms that involve the carotid jugular systems must be considered also in the differential diagnosis

4

Chest

THORACIC CAGE

The thoracic cage may be involved in malformations inflammations neoplasms and traumatic conditions

DEFORMITIES

The *congenital condition* known as *funnel chest* (pectus excavatum) presents a depression and concavity of the sternum It may result from trauma In most cases it is asymptomatic, but serious pressure effects on the heart the great vessels the esophagus and the liver can occur If pressure effects are present it becomes necessary to remove the offending part of the chest wall Another condition which results in a thoracic malformation is absence of the anterior thoracic wall (complete or partial) This may be associated with displacement of the heart outside of the thoracic cavity (ectopia cordis) The overlying skin may be absent Fortunately the condition is rare

INFLAMMATIONS

Inflammations of the chest wall result from the ordinary pyogenic infections Frequently they manifest themselves as subpectoral or subscapular abscesses both of which are worthy of special mention

A **subpectoral abscess** arises from an infection which begins in the loose areolar tissue beneath the free border of the pectoralis major or the pectoralis minor The constitutional symptoms can be severe The swelling is apparent under the outer border of the pectoralis major muscle Localized hyperemia may be absent Any movement of the arm is painful, particularly adduction and outward rotation If adequate drainage seems to have been instituted in infections of the superior extremity or the breast and constitutional effects persist, a subpectoral abscess must be considered

Subscapular abscess is rare. Frequently it is mistaken for a tumor of the chest wall or the scapula. There may be an absence of local evidence of inflammation

Osteomyelitis of the sternum and the ribs is rare However, secondary osteomyelitis is more frequent especially after surgical drainage of an empyema Tuberculosis is the most common inflammatory disease of the ribs and the sternum except for those that follow compound injuries Usually a swelling is noticed by the patient It is soft and not red Signs of fluctuation are present Aspiration reveals the characteristic curdy pus

NEOPLASMS

Tumors of the chest wall usually arise from bone So-called *osteomas* have been described but practically all of these contain cartilage *Enchondromas* are often malignant This is particularly true of the cartilaginous tumors which arise from the costal cartilages They are rarely found in the scapula The most frequent malignant tumor arising in the chest wall is *sarcoma Carcinoma* of the chest wall is secondary except those that arise in the mammary gland or skin The so-called *superior pulmonary sulcus tumor* has been described by Pancoast and is located at the thoracic inlet It is believed to arise in the fifth pharyngeal

pouch and presents some features of carcinoma The present concept is that Pancoast tumors are bronchiogenic carcinomas that have arisen from a small bronchus in an upper lobe of the lung and have invaded the superior pulmonary sulcus (p 67)

Injuries

These injuries are conveniently classified as nonpenetrating and penetrating

Nonpenetrating Injuries These are particularly important because vital intrathoracic structures and functions can be involved without external evidence of injury or fracture to the chest wall Fractures of the bony cage without external evidence of injury are common Numerous complications may result however 3 deserve particular attention intrathoracic hemorrhage tension pneumothorax and mediastinal emphysema

Intrathoracic Hemorrhage. This complication may result from injury to lung vessels intercostal vessels or internal mammary vessels. Hemoptysis is usually present when the lung is lacerated The early development of shock is suggestive of bleeding within the thoracic cavity Pneumothorax may be associated with such an injury (hemopneumothorax) Lacerations of the great intrathoracic blood vessels are rapidly fatal Bleeding from the lung parenchyma is more readily arrested spontaneously than bleeding from the internal mammary or the intercostal artery

When the lung is injured air escapes into the pleural cavity and adds pressure to the already increased pressure from blood. This is especially dangerous if the tear in the lung acts as a valve and produces the so-called tension hemopneumothorax (p 49)

The symptoms of progressive bleeding are pallor restlessness thirst increased pulse rate and a reduction in the volume of the pulse Periodic recording of the pulse rate and blood pressure are mandatory Pressure on the large thoracic veins is accompanied by a sense of tightness in the chest increased pulse rate, shallowness of breathing cyanosis, and engorgement of the veins of the neck The outstanding sign is displacement of the apex beat toward the opposite side hence the importance of marking frequently the position of the cardiac apex Dullness to percussion is noted over the involved area

Since blood is irritating to the pleura a secondary pleural effusion develops which may be massive within the first 24 hours Such effusion added to the already present



Fig 47 Roentgenogram revealing fluid and air in the chest.

blood produces a rapid increase in intra pleural pressure which leads to dangerous compression symptoms

Unless a foreign body or infection is present blood in the pleural cavity does not clot There is a deposition of fibrin and endothelial cells which eventually becomes organized and forms a so-called peel The visceral and the parietal pleurae then become encased in dense fibrous tissue and produce a frozen chest This prevents the lung from expanding and results in an immobile contracted chest which is accompanied by scoliosis and crowding of the ribs

Roentgenograms are most helpful in ascertaining the diagnosis (Fig 47) Aspiration is advocated by some for diagnostic purposes as well as being consistent with *safety and comfort of the patient*

TENSION PNEUMOTHORAX This condition results from a type of injury to the bronchial tree which permits the entrance of air *into the pleural cavity but prevents its exit* (Fig 48) Alarming symptoms of respiratory embarrassment can occur which require prompt aspiration of the trapped air Immediate diagnosis is *mandatory Owing to* the positive intrapleural pressure the intercostal spaces on the affected side are widened and the normal intercostal depressions are obliterated The thorax *on the involved* side is immobile and distended and looks smooth and bulging as compared with the other side It is necessary to view the un

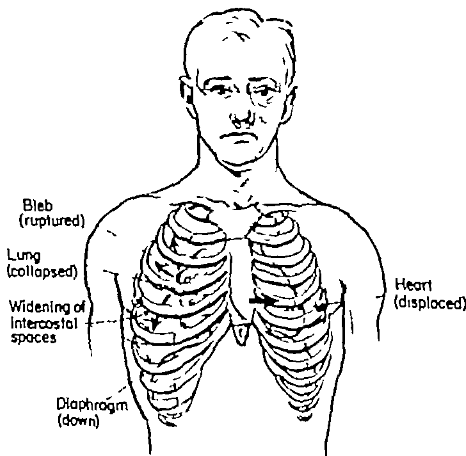


FIG 48 Tension pneumothorax This is produced by an injury to the tracheobronchial tree or lung which permits air to enter but not leave the pleural cavity

covered chest as a unit so that both sides may be compared If the mediastinum is not fixed, the trachea and the apex beat will be displaced The percussion note is hyper resonant, and vocal fremitus is absent over the affected side The diaphragm may be displaced downward if the tension is marked A flat roentgenogram confirms the diagnosis (Fig 49)

Mediastinal Emphysema This condition usually occurs after laceration of the trachea or a main bronchus Air may also escape into the mediastinum from a perforated esophagus, from a rupture of an overdistended alveolus or from a pneumothorax accompanied by rupture of the mediastinal pleura (Fig 50) The escaped air travels from the mediastinum throughout the body The main symptom is pain which may be anginal in type dyspnea is marked if the accumulation of air is considerable Subcutaneous emphysema is present in the neck, and a tympanitic note is elicited over the mediastinum sometimes the latter is associated with obliteration of cardiac dullness The subcutaneous tissue crackles (crepitation) this is most marked over the neck and the face but may be found as far down as the feet. The air apparently travels along the course of the blood vessels

Penetrating Wounds. The complications associated with nonpenetrating injuries may be present also with penetration Infection is due to the direct introduction of pathogenic bacteria and/or to the retention of a foreign body

When there is an *opening in the chest wall*, normal respiration becomes disturbed (Fig 51) In an open pneumothorax, air rushes to the area of lesser pressure within the pleural cavity As the intact chest wall *on the opposite side* expands with inspiration, the mediastinum is pulled to the sound side by increased negative pressure, and the contralateral lung fails to expand completely During expiration more air passes out through the opening in the chest wound than through the glottis and the mediastinum swings back to the mid line or beyond it This to-and fro motion of the mediastinum is called *mediastinal flutter* Pathologic alterations in circulatory dynamics result The efficiency of the pumping action of the thorax in returning venous blood to the right heart is interfered with, and the venae cavae and other great vessels may



Fig 49 Flat roentgenogram of a pneumothorax. The mediastinal structures are displaced to the opposite side.

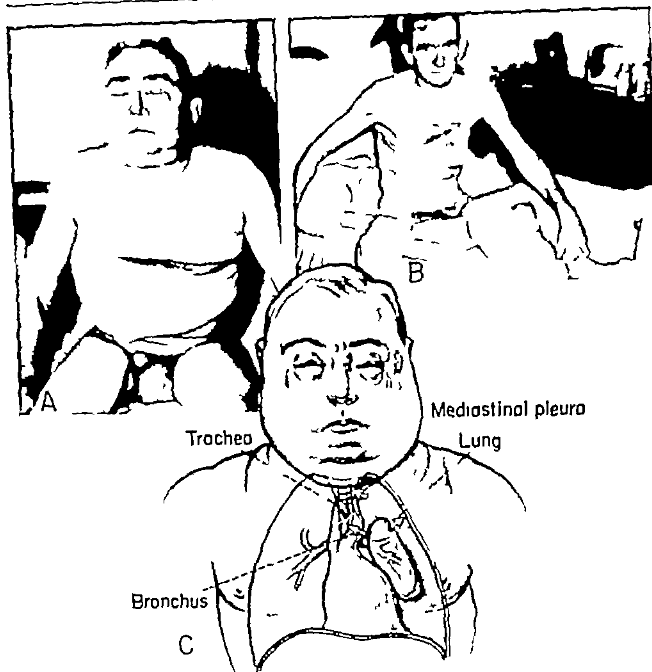
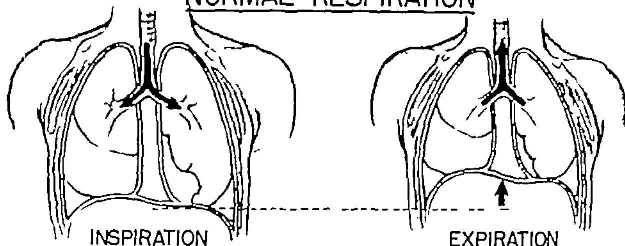


FIG 50 Subcutaneous emphysema This can result from a pneumothorax or a tear in the trachea the bronchus or the esophagus frequently it is accompanied by a rent in the mediastinal pleura. (A) This patient had a chest injury and developed a crackling subcutaneous emphysema which extended from his head to his feet A reten tion catheter was necessary because of the severe genital emphysema (B) The same patient 10 days later (C) Injuries which might produce mediastinal emphysema.

become kinked There is also a useless inter change of poorly oxygenated air between the two lungs These conditions must be corrected rapidly

The diagnosis is not difficult since an open sucking thoracic wound is apparent The open pneumothorax must be closed To be differentiated are compression of pulmonary parenchyma by blood or air (p 48) and obstruction of the airway by blood or secretions When partial obstruction of the airway is present rales and rhonchi are



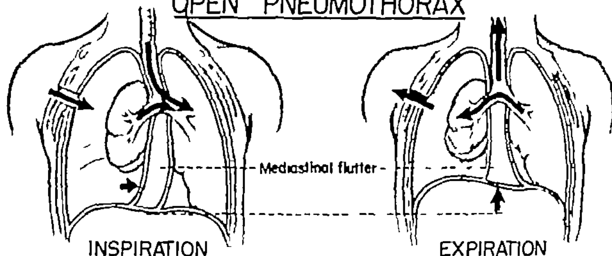


FIG 51 Open pneumothorax and mediastinal flutter Air rushes into an open chest wound during inspiration because of diminished pressure within the pleural cavity Expansion (inspiration) pulls the mediastinal contents toward the sound side, and the contralateral lung fails to expand completely During expiration a greater amount of air can pass out the chest wound than out the glottis and the mediastinum swings to the mid line or beyond it. This to-and fro motion is called mediastinal flutter Normal respiration has been shown for comparison

audible Frank hemoptysis also may be present. If a large amount of air is removed from the pleural cavity and re accumulates rapidly causing recurrent dyspnea a tension pneumothorax must be suspected With this a subcutaneous emphysema usually is found

Paradoxical motion is caused by severe crushing injuries and often is associated with multiple rib fractures (Fig 52) Normally on inspiration all portions of the thoracic cage move outward and the diaphragm moves downward during expiration motion is in the opposite direction. The flexible area is pulled inward on inspiration and pushed outward on expiration Paradoxical motion is present sometimes following thoracoplasty and diaphragmatic paralysis As a result of this, ventilatory efficiency is diminished and there is also a

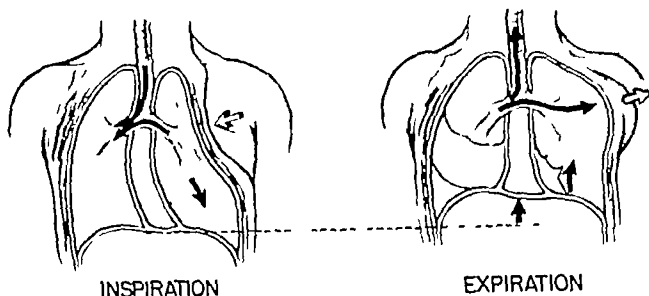


FIG 52 Paradoxical motion The flexible area is pulled inward on inspiration and pushed outward on expiration A useless exchange of stagnant air within the lungs results The mediastinum swings, and circulatory dynamics become seriously altered.

useless exchange of stagnant air within the lungs. On inspiration, air is "pulled in" from the portion of the lung underlying the area of paradoxical motion into expanding portions of both lungs during expiration part of the expiratory air is "pushed out" into the portion of the lung that balloons the flexible part of the chest wall (Fig 52) Should this paradoxical motion involve a large area there is a wide swing of the mediastinum and the circulatory dynamics may be altered seriously The venous pressure rises, filling of the right side of the heart becomes inadequate and the arterial pressure eventually falls

Recognition of these abnormalities should not require elaborate armamentarium A stethoscope and a thoracentesis tray should be adequate Early accurate diagnosis is mandatory since the results of treatment are highly satisfactory

DISEASES OF THE PLEURA

PLEURISY

The parietal layer of pleura lines the internal aspect of the chest wall It is thicker than the visceral layer that invests the lung The visceral pleura dips down into the interlobar fissure lining them Whereas it is impossible to strip the visceral layer from the lung it is quite easy to separate the parietal pleura from the parts that it covers except over the heads of the ribs the vertebral column the diaphragm and the pericardium The two pleural layers are separated by a thin film of fluid which acts as a lubricant between these sliding surfaces The normal pleura can rapidly absorb various solutions toxins and dyes, by means of both the blood and the lymph vessels

Inflammation of the pleura (pleuritis) may be caused by trauma or infection The initial response is congestion of the pleural membranes The inflamed membrane becomes thickened, and an inflammatory exudate pours into the pleural cavity This may vary from a few cc. to several pints At first it is straw-colored but may become turbid because of the presence of pus cells the presence of blood gives it a red color which varies in the depth of its intensity If the pleurisy is due to an acute infection the causative organisms and leukocytes may be found in the fluid However if it is due to tuberculosis it may be impossible to detect

the organisms without special tests. In the latter instance the predominant cells are likely to be lymphocytes A purulent pleuritis (empyema) which presents many important problems will be discussed subsequently (p 55) Any inflammation may result in pleural cicatrisation these may vary from localized adhesions to a thickened solid shell covering both pleural membranes. If the diaphragmatic pleura is involved pain can be referred along the sensory fibers of the lower intercostal nerves this may be mistaken for an abdominal condition

Pain is usually present on the involved side, this may be sharp stabbing or tearing. It is aggravated by coughing deep inspiration or pressure and it is most intense at the end of inspiration The pain disappears when the pleural fluid appears Dyspnea, pyrexia and the presence of a pleural friction rub are usually present. The term pleurisy with effusion" is a latter stage of so-called "dry pleurisy " The etiologic factors of pleurisy with effusion may be injury inflammation, neoplasm of the chest wall and parietal pleura, foreign material (especially blood) and lesions of the lungs and the visceral pleura

A noninflammatory transudation of

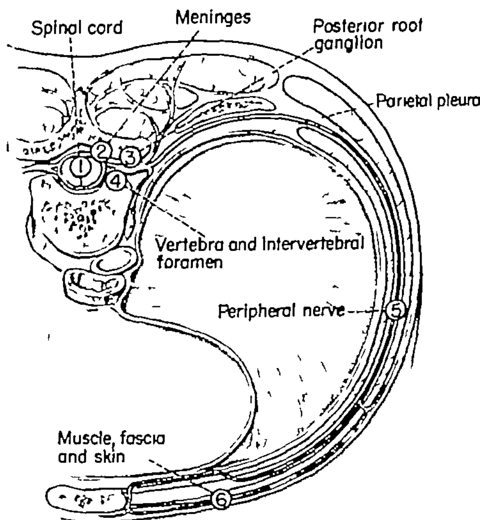


FIG. 53 Pleural pain The pain associated with pleurisy may be confused with conditions involving the structures enumerated in the illustration.

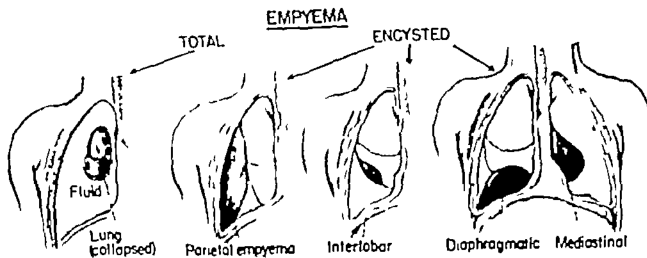


FIG 54 Types of empyema thoracis The total empyema has no limiting fibrinous adhesions

fluid may be present in the pleural cavities and occur as a complication of heart or kidney disease ovarian fibroma (Meigs) or because of a tumor compressing the pulmonary veins

Although pain in the chest may be the main feature of a diseased pleura other conditions which may be associated with referred pain are caused by lesions of the spinal cord the meninges the posterior root ganglia involvement of the foramina peripheral nerve pathology and diseases of the muscles the fascia and the skin (Fig 53)

Effusion affects the contents of the thorax, and it has been estimated that at least a half a pint of fluid in the pleural cavity of the average sized chest is necessary to produce changes that can be detected *clinically* Normally the heart and the mediastinum maintain their median *position* by the elastic traction of both lungs When an effusion collects in the *pleural cavity* the corresponding lung is compressed and traction of the lung *on the sound* side pulls the mediastinum toward it This is possible only if the *mediastinum is not* fixed Therefore it is thought that the displacement of the *heart is not a pushing* to the opposite side by the pressure of the fluid When fluid accumulates in a pleural cavity the intrapleural pressure on that side becomes *less negative* with the result that the now relatively larger negative pressure on the sound side pulls the mediastinal contents toward it

The *physical signs* that are associated with pleural effusion are dullness on percussion displacement of the apex beat, and an absence of normal vesicular breath sounds The patient has a tendency to lie *on the* affected side which permits him to get maximum expansion of the healthy lung If the effusions are massive the intercostal depressions *are obliterated on the diseased side* Voice and breath sounds are absent over the *area of effusion* The roentgenogram is most helpful in diagnosing effusions and associated lung lesions It may become necessary to withdraw 5 or 10 cc. of fluid to arrive at a diagnosis through proper bacteriologic, cytologic and chemical investigations

EMPYEMA

Acute empyema, more properly designated as **empyema thoracis**, is a condition in which pus is present in the pleural cavity (an abscess of the pleura) Purulent pleural effusions for practical purposes are always considered secondary Although they may be due to any pathogenic organisms the most frequent ones are *pneumococcus* and streptococcus It is usually a complication of some type of pneumonia except when it

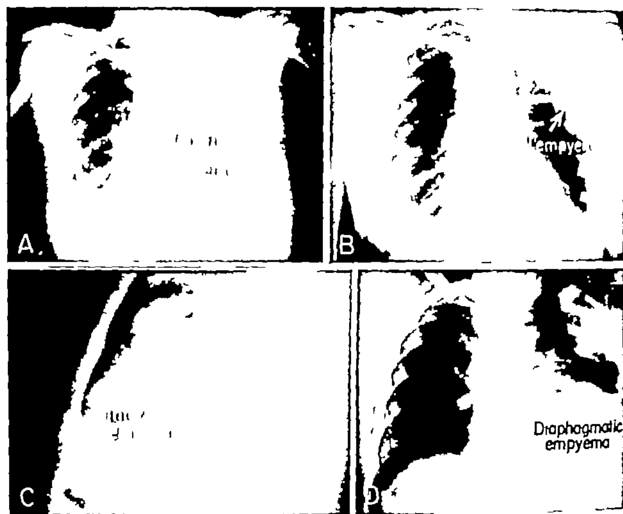


FIG 55 Roentgenograms revealing types of empyemas.

occurs with a penetrating wound of the chest or by a spreading upward of an abscess beneath the diaphragm When due to the pneumococcus it is usually the sequel of a lobar pneumonia when streptococcus is the offending organism it most often is a complication of bronchopneumonia when other pyogenic organisms are present it is usually a complication of some suppurative inflammation of the lung such as bronchiectasis or pulmonary abscess Staphylococcal empyema more frequent in infants requires special mention because this type of pneumonitis is associated with multiple small peripheral abscesses which may rupture into the pleural cavity with the development of a pyopneumothorax.

Empyema may be one of two types namely a *total empyema* with no localizing adhesions or an *encysted empyema* in which localization is brought about by adhesions between the lung and the thoracic wall. Other types of encysted empyemas are interlobar diaphragmatic and mediastinal (Figs. 54, 55)

It usually takes from 10 days to 2 weeks for the development of frank pus. Bilateral empyema is far less common than the unilateral variety So-called *empyema necessitatis* is an unusual complication in which there is a spontaneous perforation through the chest wall Fibrin is deposited on both pleural layers In chronic cases the pleural membranes particularly the parietal, may become tremendously thickened measuring an inch or more

The physical signs are those which are found in connection with any fluid in the pleural cavity (p 55) In early cases the mediastinal contents are displaced to the healthy side but chronic fibrotic changes result in displacement toward the affected side A diagnosis of interlobar empyema is difficult the condition may be confused with a lung abscess or a consolidated area of lung parenchyma Clubbing of the fingers and the toes is present in subacute and chronic cases (Fig 65) The roentgenogram reveals fluid in the chest or a combination of fluid and gas The ultimate diagnosis depends upon exploratory aspiration or operation A high polymorphonuclear leukocytosis is nearly always present

The complications most commonly associated with empyema are bronchial fistula, perforation through the thoracic wall blood stream infection suppurative pericarditis peritonitis mediastinal abscess and a host of other complications which include meningitis brain abscess and arthritic manifestations Scoliosis is present in the chronic and neglected cases

The creation of an open pneumothorax by the establishment of drainage of the pleural cavity should not be undertaken until frank pus has been demonstrated by aspiration During the formative period of an empyema there is little or no stabilization of the mediastinum because of the lack of development of firm adhesions Few patients will die of acute empyema per se but many will die from an injudicious operation performed too early The correct diagnosis as to type of fluid must be most exacting If on aspiration (thoracentesis) clear or turbid fluid is revealed it is unwise to operate Such aspiration can be repeated to relieve pressure effects or to determine the type of fluid

Chronic empyema is frequently caused by a failure to provide adequate drainage of an acute empyema Other causes of this condition are foreign bodies communications with bronchial or lung fistulas unobliterated fibrotic cavities tuberculosis and other infections Rare infections which involve the pleura are tuberculosis syphilis actinomycosis blastomycosis and streptotrichosis Injection of radiopaque material into a draining sinus may aid in determining the size of the empyema cavity Study of the discharge and biopsies of pleura are also diagnostic aids

Tumors

Tumors both benign and malignant attack the pleura frequently these are associated with breast carcinoma So-called endothelioma has caused much confusion in the literature Whether it is primary in the pleura or metastatic from a bronchus carcinoma is still moot Primary malignant tumors of the pleura are usually a type of sarcoma Benign tumors such as lipoma fibroma angioma and leiomyoma have been reported Regardless of whether the lesions are benign or malignant almost all are associated with pleural effusions If the tumor is malignant the fluid appears bloody Cytology exploratory thoracotomy and biopsy are helpful methods in arriving at a final diagnosis Occasionally, areas of calcification in the pleura may simulate a new growth Congenital as well as echinococcal cysts must be differentiated also

DISEASES OF THE TRACHEA

The conditions that involve the trachea are relatively few

Foreign bodies are common but with the advent of the bronchoscope most of these are diagnosed and treated readily

Tumors of the trachea are rare The benign neoplasms may be fibromas lipomas, papillomas chondromas, chondro-osteomas and lymphomas Of the malignant tumors carcinoma is found more frequently than sarcoma although both are infrequent. The benign tumors occur more frequently in the upper third of the trachea but the malignant lesions are found more commonly in the lower third Symptoms suggestive of a



FIG 56 Chicken bone in the right bronchus producing lung abscess. (A) Questionable lesion in the right lung (B) Abscess demonstrated 3 months later (C) Extracted chicken bone

malignant neoplasm are coughing hemoptysis dyspnea and pneumonitis Metastases usually occur late If the tumor arises in the posterior wall early perforation might be expected.

Tracheo-esophageal fistulas are relatively infrequent and usually occur as a complication of carcinoma of the esophagus (p 82)

DISEASES OF THE BRONCHI

Obstructive Lesions

An obstructive lesion of a bronchus (bronchostenosis) may be complete if so, it is followed by an absorption of air in that portion of the lung to which the involved bronchus leads this results in *atelectasis* (p 64) Because of the straighter direction of the right bronchus the right lower lobe is involved most frequently Foreign bodies are aspirated with greater ease into the right bronchus Obstructive lesions are not always due to foreign bodies but may be caused by new growths scars which result from severe inflammations or mucus plugs.

Foreign Bodies

Frequently foreign bodies are aspirated by children or by inmates of mental institutions If the aspirated object is nonopaque it will not be seen on the roentgenogram a typical example of this is peanuts. Immediately after such aspiration the patient coughs violently becomes cyanotic and usually complains of dyspnea Cyanosis is less marked if the foreign body is located in the larynx or the trachea. Serious complications result from these foreign bodies if they are not removed The inflammation which results produces destruction of the cartilaginous walls and bronchiectasis Associated with this may be destruction of lung tissue with the formation of single or multiple lung abscesses and lung gangrene (Fig 56)

Foreign bodies in the bronchus may cause either partial or complete obstruction. If partial a diminished amount of air may pass in and out of the lung past the foreign body however the partial obstruction may be such that air is inspired but not expired (ball valve action) Behind such an obstruction an obstructive emphysema may result

Tumors

Most tumors which are found in the bronchi are carcinomas these will be discussed under the section dealing with tumors of the lung (p 61) The benign tumors are usually adenomas or polyps which arise from the bronchial epithelium. Confusion still surrounds the so-called *benign adenoma* consensus leans toward these being poten-

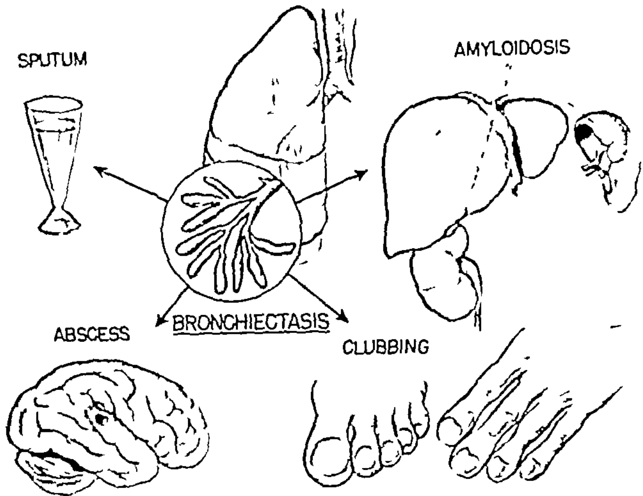


FIG 57 Bronchiectasis and some of its manifestations and complications.

tially malignant neoplasms Although this will be discussed more thoroughly presently (p 68) it must be emphasized that the differentiation between a benign and a malignant tumor of a bronchus is not always easy even with the aid of bronchoscopic and microscopic studies

FISTULA

Bronchial fistula refers to a communication between a bronchus and another organ or surface The most common bronchial fistulas are located between the bronchial tree and the pleural cavity They may result from the surgical treatment of empyema or lung abscess these usually communicate with the skin They can occur with any type of lung inflammation in which there is destruction of pulmonary tissue Hence we find them associated with pulmonary suppuration as well as pulmonary tuberculosis If a fistula communicates with a small bronchus, closure is spontaneous and rapid Larger fistulas frequently become chronic and remain open The fistula usually excretes mucus or mucupus however anything that is secreted by the organ with which it communicates may appear for example bile in bronchobiliary fistula Hemorrhage which can be serious is possible When bronchial fistulas are present there is always danger of drowning from the entrance of water into the lung through the external opening These patients must be warned not to immerse the fistula below water

Attempts always should be made to determine the size the depth and the extent of

the fistula as well as the presence or the absence of a foreign body This can be done by roentgenography and the injection of radiopaque substances Such information is important in determining the extent and the type of therapy indicated

Bronchiectasis

As its name indicates, bronchiectasis is a disease that is characterized by dilatation of the bronchi (Fig 57) It may affect the tube uniformly (cylindric) it may occur as irregular pockets (sacculated) or the dilated tubes may have bulbous terminal enlargements (fusiform)

Etiology Whether it is caused by one or a combination of factors is still unknown The etiologic factors usually mentioned are chronic bronchial infection bronchostenosis, pneumonitis and its sequel pulmonary fibrosis and pulmonary atelectasis The theory of congenital origin has not been accepted. An intriguing etiologic factor of septic bronchiectasis is that it is a penalty which modern man pays for assuming the erect posture of a biped Normally, a bronchus prevents accumulation of secretions and stasis by ciliary action and peristalsis Loss or diminution of these excretory actions in the dependent bronchi results in an accumulation of secretions which produces stasis and encourages bacterial growth

The symptoms are by no means constant If marked they are associated with spontaneous remissions and successive exacerbations It is not uncommon for the disease to exist undiagnosed for 2 or 3 decades In such instances the patient may be reduced to a state of chronic invalidism Persistently dilated bronchi unable to rid themselves of their secretions tend to become obstructed and produce recurrent alveolar atelectasis Ultimately the mucus within these bronchi becomes infected and an inflammation develops in the bronchial wall Thus the wall is weakened by destruction of its muscle and elastic fibers such dilated bronchi cannot heal.

Recurrent respiratory infections may date back to early childhood and the patient recalls frequent attacks of "colds" Each attack leaves the patient a little weaker A chronic cough develops this tends to be periodic and becomes worse in the winter The cough is worse on arising and is associated with violent bouts of coughing which persist until the bronchi are emptied of their secretions Then the patient is relieved for many hours The *sputum* varies in amount but is usually copious. Acute infections increase its volume and alter its appearance Sputum types vary from bland white or mucopurulent to a frankly deep-colored foul material The odor is excessively offensive and becomes a socioeconomic problem Because of the foul breath and coughing these people are likely to be shunned socially and have difficulty in securing steady work

Hemoptysis occurs in about half of the cases and varies in amount from a tiny fleck of blood to several hundred cc. Many of these patients are diagnosed erroneously as tuberculosis despite the fact that the tubercle bacilli are not demonstrated in their sputa

Gastro-intestinal symptoms include anorexia nausea and vomiting Frequently nausea and vomiting are associated with paroxysms of coughing Diarrhea may develop in chronic cases and suggests amyloidosis

Pain in the chest is not severe but appears as a vague heaviness. *Fever* is associated with bronchial and pulmonary infection. Clubbing of the fingers and the toes is frequently present (Fig 65) The clubbing is so gradual in its onset and progress that the patient is unaware of its presence Joint pains are not infrequent

The condition most commonly involves the lower lobes. The middle lobe on the right and the lingular segment of the left upper lobe may be involved also The percussion note is dull over the involved areas. Rales when present, are moist and medium

to coarse in intensity It is characteristic of bronchiectasis that the physical signs vary from time to time or even from hour to hour

Complications The more common complications are brain abscess and amyloidosis which particularly involves the liver the kidney and the spleen

Diagnosis. A most important diagnostic adjunct is bronchography This roentgenographic outlining of the bronchial tree with an opaque medium requires accurate positioning of the patient (Fig 58) Bronchoscopic examination is helpful in determining from which side a purulent secretion or blood eminates. Exploratory thoracotomy should be performed if the diagnosis is doubtful and also for definitive therapy

The physician must be aware continually of this common condition and realize its intractibility Its ultimately disastrous outcome makes early diagnosis and treatment imperative

BRONCHOLITHIASIS (LUNG STONES)

This condition although not too frequent, is found more often than a survey of the literature would indicate The stones vary in size from mere granules to those weighing several grams and consist of calcium phosphate and calcium carbonate They are seen in individuals who have healed pulmonary tuberculosis or other types of infections or granulomas It has been suggested that they are concrements which have ulcerated into a bronchus from calcified tracheobronchial lymph nodes Severe attacks of coughing and chest pain are frequently present Following the expectoration of the stone there is usually blood in the sputum the bleeding is due to trauma If the stone is of sufficient size it is seen on the roentgenogram It is important to be aware of such stones to avoid confusion with such conditions as tuberculosis bronchiectasis and carcinoma particularly when hemoptysis is present

LUNGS

TUMORS

Tumors of the lung are benign malignant or metastatic.



FIG 58 Roentgenographic demonstration of bronchiectasis.

Benign tumors appear in a variety of forms as fibromas, lipomas, chondromas osteomas hemangiomas polyps and cartilaginous hamartomas The questionable bronchial adenoma is listed with the malignant tumors (p 68) With the exception of hemangioma the benign tumors per se do not present unusual features They are uncommon and if symptoms are present they usually result from obstruction to a bronchus Chest roentgenograms have become a routine hence, these tumors are frequently discovered when they are still asymptomatic and small

A *hemangioma* differs because it may be associated with an arteriovenous fistula Such a fistula permits a considerable volume of unsaturated blood to return to the left heart and the systemic circulation This causes cyanosis polycythemia dyspnea weakness and as a rule, clubbing of the fingers (Fig 65) The symptoms are relieved promptly by resection of the fistula-containing lung

Also presenting some interesting features are the cartilaginous *hamartomas* of the lung This tumor is usually small and firm and moves freely in the surrounding soft lung substance It appears to be lobulated, and microscopically well-differentiated cartilaginous cells can be seen

If a tumor is discovered on routine roentgenographic examination a great responsibility is placed upon the physician Such a lesion may be a benign tumor, a tuberculoma, primary carcinoma metastatic carcinoma a cyst or an abscess Tuberculomas should be suspected if signs of tuberculosis are present elsewhere in the lung and if calcium deposits are noted in the spherical lesion Chondromas and cartilaginous hamartomas may also reveal areas of calcification.

The term *coin lesion* has been applied to a spherical well-circumscribed intrathoracic

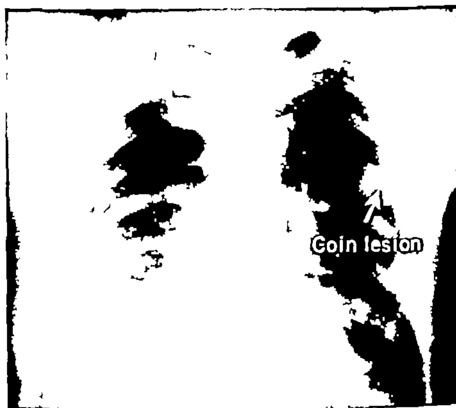


FIG. 59 Roentgenogram of a so-called coin lesion.

nodule which is demonstrated on the roentgenogram (Fig 59) Any of the previously mentioned conditions may present the roentgenographic appearance of a coin lesion If a diagnosis of a benign tumor of the lung could be established with certainty one would be justified in withholding exploratory thoracotomy Since these lesions are discovered accidently and since they are usually asymptomatic, the proper course of therapy is difficult to outline however positive diagnosis is made with the greatest degree of certainty only when exploration and biopsy are performed Other methods used to aid in the diagnosis are sputum examination cytology bronchoscopic study specialized roentgenographic methods and intensive thorough study to search for a possible extrathoracic primary tumor

Malignant tumors of the lung are unfortunately common *carcinoma* is the most common type It usually appears in the so-called "cancer age" groups which constitute the fifth and the sixth decades It is 6 times more common in males Little is known of the etiology Those conditions which have a tendency to produce chronic irritations of the respiratory tract have been singled out as causitive factors Such irritative agents are those associated with smoking exhaust gases coal tar products lung abscess silicosis bronchiectasis tuberculosis and chronic bronchitis

A practical classification for these growths is based upon their site of origin Therefore, they are divided into 2 groups *hilar* lesions which include those arising in a primary stem bronchus (75%) and *peripheral* lesions located toward the lung surface (25%) The latter are difficult, if at all possible to see through the bronchoscope (Fig 60) If the tumor is near the hilum cough and hemoptysis may be early symptoms and bronchoscopy usually reveals the neoplasm If the tumor is peripheral local symptoms may be lacking until either the pleura is involved or metastases occur

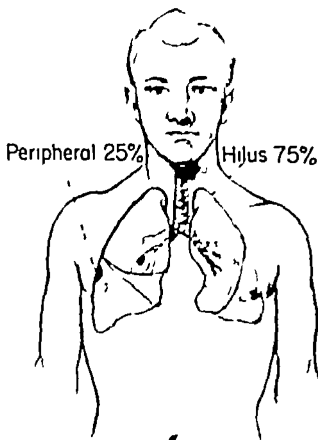


Fig 60 Carcinoma of the lung can be classified according to location Hilar lesions include those originating in a primary stem bronchus peripheral lesions are at the lung surface

Signs and Symptoms The clinical picture is not stereotyped It varies so tremendously from patient to patient that it is best to consider the symptomatology in the light of the growth of the tumor (Fig 61)

An *early* neoplasm growing in the bronchial wall acts as a foreign body, and the patient attempts to expel it by *coughing* As the tumor increases in size it may ulcerate and bleed and produce hemoptysis Such hemorrhage varies from a few specks of blood to copious hemorrhage the latter is uncommon

Later, as the growth increases it may produce an incomplete blockage of the involved bronchus This interferes with proper ventilation of the corresponding lobe and the patient becomes conscious of an inability to expand the lung fully especially on exertion At a comparative early stage some degree of *cyanosis* may be present Wheezing may be

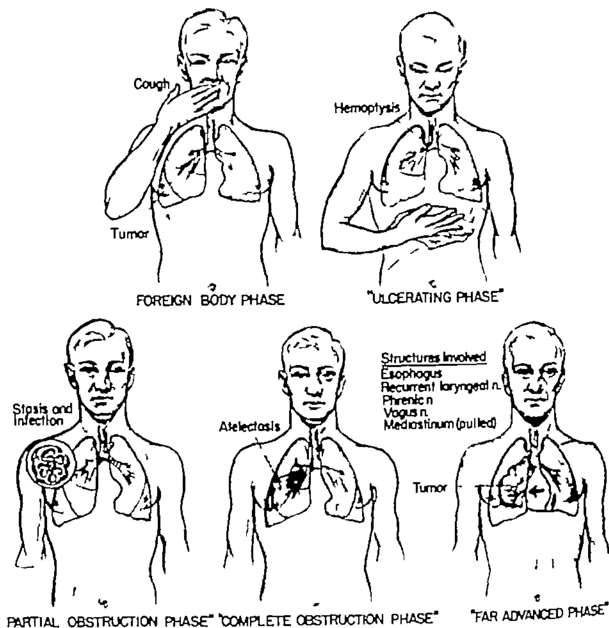


FIG 61 The symptomatology as related to the growth of carcinoma of the lung. These phases must not be considered in a dogmatic fashion, since they can overlap or skip. The patient may be seen for the first time in any phase

heard over the narrowed bronchus It is particularly significant when it is sharply localized and unilateral Partial bronchial obstructions interfere with free drainage of secretions, and stasis results This predisposes the patient to infection and bouts of fever Such attacks are overlooked as colds" or attacks of flu Pneumonia abscess or pleurisy are frequent complications. (Fig 61)

When the bronchus becomes completely *blocked* the air in the alveolae distal to the lesion becomes absorbed *(atelectasis)* The mediastinum is displaced toward the affected side and the ribs are pulled inward. Physical examination is helpful if the chest expands poorly on the involved side this is accompanied by dullness and a complete absence of breath sounds Toxemia, loss of weight and anemia are late signs.

As the growth progresses it may involve such mediastinal structures as the phrenic nerve the recurrent laryngeal nerve the esophagus the sympathetic nervous system the superior vena cava and the vagus nerve (Fig 61)

If the growth originates near the periphery of the lung there is an early appearance of *pleural effusion* this can be serofibrinous but more often is hemorrhagic The study of such fluid may reveal tumor cells

Carcinoma of the lung differs from other carcinomas in that it produces *pain relatively early* Such pain is not pleuritic but



Fig. 62 Roentgen appearance of a proved bronchiogenic carcinoma as seen in the so-called silent phase Such lesions are discovered accidentally with routine roentgen screening of chests

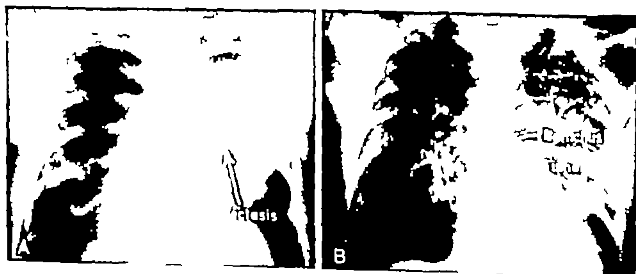


Fig 63 Roentgenogram of pulmonary atelectasis caused by a lung carcinoma

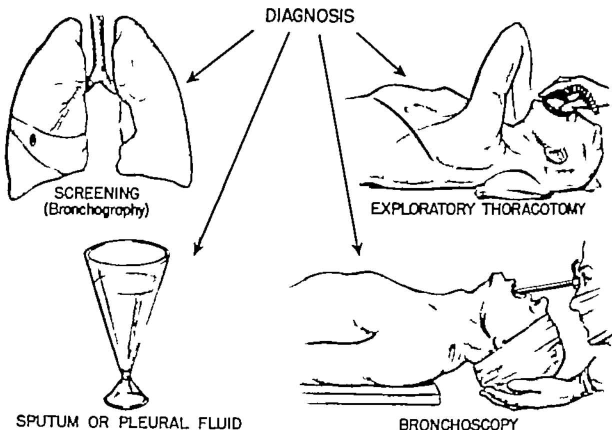


FIG 64 Diagnosis of carcinoma of the lung The cytologic study on sputum or pleural fluid is helpful only if the results reveal malignant cells.

is rather dull and situated deep in the chest. It is surprising how often the patient can localize this area of pain correctly

Hemoptysis is present in about 50 per cent of the cases Any patient who complains of a bloody sputum must be examined immediately for *the big three'* (1) carcinoma of the lung (2) tuberculosis, (3) bronchiectasis Although other conditions might produce hemoptysis, these 3 conditions must be ruled out first.

The so-called silent phase of carcinoma may be detected with a routine roentgen screening of the chest (Fig 62) It has been stressed that the air within the expanded lung provides a good natural contrast medium for the early detection of density changes in the lung Small tumors growing in the *periphery* usually cast a direct shadow Small tumors that are *centrally located* cause segmental bronchial obstruction which may be seen as a corresponding thinned atelectatic segment (Fig 63) Since an airless segment will cast a shadow many times the size of the tumor itself these lesions should be demonstrable. Well-qualified roentgenologists stress that it is possible to demonstrate a lesion in the lung prior to the appearance of symptoms. They emphasize the importance of demonstrating the following roentgenographic findings segmental emphysema, a difference in the size of the root of the 2 lungs, linear atelectasis, and a nodule in the periphery Any or all of these should be considered as carcinoma until proved to be otherwise.

Routine screening of the entire population should be carried out. If any suspicious le-

sions appear, stereoscopic and tomographic studies should be made Cytologic examination of the sputum and the pleural fluid should be done Bronchoscopic examination may be most informative if all of the tests are inconclusive exploratory thoracotomy should be done (Fig 64)

Clubbing of the fingernails may be the first indication of lung carcinoma (Fig 65) It has been stressed that this osteoarthropathy may precede the usual signs and symptoms including roentgenographic findings by many months When joint pain (arthralgia) is also present it is due practically always to a pulmonary malignant lesion or a pleural mesothelioma, never to tuberculosis

When a peripheral carcinoma is located in the lung apex a so-called *Pancoast tumor* is diagnosed (p 48) This is characterized by involvement of the ribs the brachial plexus the axillary vessels and the sympathetic nervous system This results in pain in the shoulder impairment of circulation of the upper extremity and an ipsolateral Horner s syndrome (ptosis meiosis and enophthalmos) It is not unusual for the first symptoms of a peripherally located lung carcinoma to appear as remote metastases in the brain or skeleton

In the differential diagnosis of pulmonary carcinoma the two conditions which are also associated with hemoptysis namely tuberculosis and brochiectasis must be ruled out Other lesions may simulate carcinoma *Lipoid pneumonia* is associated with the instillation of oil into the nose and the throat or the oral intake of liquid petrolatum and allied preparations Also to consider is an unusual condition known as *tracheopathia osteoplastica* This results from small nodulations of osseous tissue beneath the mucosa and between the cartilaginous rings of the trachea and the main stem bronchi Also hemoptysis may be associated with this condition *Chronic pneumonitis* and *pulmonary*



Fig 65 Clubbed fingers. This is a condition characterized by enlargement of the terminal phalanges and curving of the nails It is secondary to *chronic conditions* of the lungs and the heart It may involve the toes Other names have been applied to the condition such as hippocratic nails osteoarthropathy and pseudohypertrophic osteoarthropathy This may be the earliest sign of lung cancer

fibrosis must be considered Broncholithiasis was mentioned previously (p 61) *Bronchial adenoma* is one of the most interesting, confusing and controversial tumors involving the bronchial tree The majority of authorities are of the opinion that this lesion should be considered as a carcinoma with a slow rate of growth and with a tendency for the late development of metastases Therefore, the term 'bronchial adenoma' is a misnomer but probably will continue to be used because of habit or early teaching This lesion is located characteristically either in a main bronchus or in a primary bronchial division Grossly, it is distinguishable from carcinoma. It occurs with equal frequency in both sexes

Metastatic Neoplasms. These pulmonary lesions are particularly important when one realizes that in recent years the resection of pulmonary tissue containing metastases has produced relief in some cases. The presence of such tumors does not always imply widespread dissemination hence an over all pessimistic attitude is not justifiable The blood vascular spaces of the lungs represent the first major obstruction for tumor cells that arise in the somatic areas of the body Malignant emboli that enter the portal vein and its tributaries are likely to be stopped by the sinusoids of the liver Later they may spread to the lungs via the hepatic veins and the vena cava The lungs can be involved through the lymph channels and also by direct extension from adjacent structures. Primary tumors that spread to the lungs by the blood vascular spaces include sarcomas, particularly Ewing's tumor and osteogenic sarcomas Thyroid carcinoma, hypernephroma and chorio-epithelioma are the most common offenders in the carcinoma group. Metastatic tumors of the lungs are often spherical in shape and sharp in outline If multiple, they are roughly uniform in size (Fig 66) If the tumors are multiple and small an early fatal prognosis is self-evident however the solitary metastatic lesion should be looked upon with some hope for survival Such solitary lesions warrant removal



FIG 66 Roentgenogram of metastatic tumors of the lung.

Congenital Conditions

Various congenital abnormalities may affect the lungs. Occasionally an entire lung may be absent. Another condition that has been described is one in which the fetal state has been maintained so that the lung never has expanded. Variations involving the fissures and the lobes have been recorded frequently.

Congenital cystic disease of the lung has received great attention in the past few years. It has been known also as fibrocystic adenoma pulmonare. The cysts may be single or multiple, small or large; they have a tendency to be confined to a single lobe, although the condition may be bilateral. They are filled with either air or fluid. If asymptomatic, they are discovered accidently on routine roentgenographic examination of the chest. At times they give rise to alarming symptoms. If the cyst communicates with the bronchial tree through a narrow aperture, a valvelike action results in which air is drawn in during inspiration but prevented from escaping on expiration. Such an air filled cyst rapidly increases in size, compresses the surrounding lung parenchyma and displaces the mediastinum to the opposite side. The clinical signs and symptoms resemble a tension pneumothorax (p 49), including cyanosis, dyspnea, enlarged veins of the neck, and tachycardia. Death may occur if the condition is not diagnosed and treated rapidly. Needle aspiration to relieve the tension may be a lifesaving procedure. Cysts can become infected; the patient then presents the general signs and symptoms of sepsis plus localizing signs of a lung abscess (p 71). The underlying condition is not suspected until bronchography is done. The demonstration of multiple cystic spaces may lead to an erroneous diagnosis of bronchiectasis. The differentiation between bronchiectasis and small multiple congenital cysts of the lung may be extremely difficult, particularly if the cysts are associated with chronic secondary infections.

Infections

The common surgical infections are pneumonitis, lung abscess, gangrene and tuberculosis.

Pneumonitis occurs in either acute or chronic forms. The *acute* type is important to the surgeon because of the frequency with which it follows surgical procedures (postoperative atelectasis). The *chronic* nontuberculous inflammatory lesions of the lung are of equal significance because they must be differentiated from bronchiectasis, carcinoma, tuberculosis and lung abscess. The chronic form is a disease which occurs most frequently in middle aged males. It is characterized by an insidious onset, a productive cough, pain in the chest, hemoptysis and a low grade intermittent fever. The cough and the chest pain may be present for several years prior to the appearance of the hemoptysis. Of diagnostic importance is the fact that unlike many other chronic pulmonary diseases this condition does not have the noticeable effect upon the general condition of the patient. Bronchoscopic examination usually reveals an associated bronchitis; bronchography rules out bronchiectasis. The roentgenogram reveals an area of increased density lacking sharp demarcation from the surrounding lung tissue. Since conservative treatment usually suffices, a correct diagnosis is imperative. The right middle lobe is affected most commonly, but more than one lobe or bilateral involvement has been reported.

Pulmonary abscess and gangrene, which formerly were considered as separate lesions, should be considered together. An extensive gangrene of the lung can become an abscess, or an abscess may produce a gangrenous process. Although the condition is less frequent and less dangerous since the advent of improved technics of anesthesia and antibiotic therapy, it still is serious when present. About half the cases of lung abscess result from pneumonia. The majority of the remaining cases reveal a history of aspiration of infected material. Tonsillectomy has been



Fig 67 Roentgenogram of the Ghon tubercle and primary pulmonary complex.

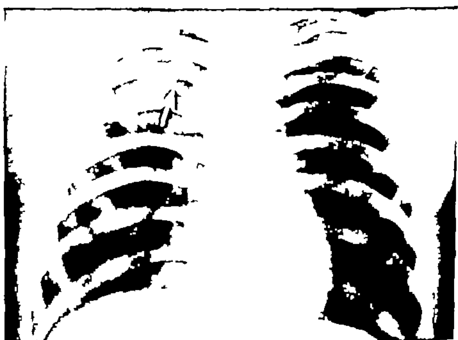


Fig 68 Roentgenogram of tuberculosis involving the right upper lobe.

the greatest offender In children lung abscesses frequently result from the aspiration of foreign bodies Other causes are infected chest wounds congenital cystic disease and bronchiectasis The putrid sputum contains spirochetes fusiform bacilli pneumococci staphylococci and hemolytic streptococci Cough is the most common symptom also, hemoptysis may be present Roentgenographic examination is of great value in the localization of the abscess If the roentgenogram is taken early an area of increased density is noted later in the course of the disease and after bronchial communication has been established the abscess cavity is seen, and a fluid level is present Bronchoscopic examination is particularly helpful and also rules out or identifies an associated foreign body or tumor Bronchoscopy also aids in aspiration of mucus and pus and provides a means of drainage The abscess may perforate into the pleural space giving rise to empyema It may rupture into the pericardium and the mediastinum *Brain abscess* as a complication of lung abscess is due to the passage of septic emboli from areas of thrombophlebitis in the intercostal and the bronchial veins by way of the azygos and the spinal veins upward to the brain.

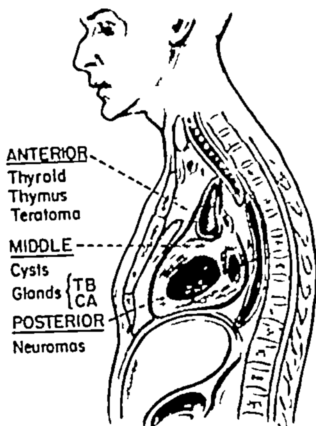


FIG 69 Mediastinal enlargements In the anterior mediastinum are masses associated with the thyroid, thymus and teratomas the middle mediastinal growths are related to bronchogenic cysts lymphomas and metastatic and tuberculous lymph glands the posterior mediastinal tumors are predominately neurogenic.

Pulmonary Tuberculosis. The primary involvement of the lung by the tubercle bacillus results in the formation of the Ghon tubercle (Fig 67) This is a small nodule usually located in the peripheral portion of the midzone of the lung Secondary foci of tuberculosis in the hilar lymph glands are also present with the primary tubercle This primary complex heals with scarring and calcification. A positive cutaneous reaction to tuberculin may be obtained later this is the most obvious clinical manifestation. Occasionally the primary form of the disease may be progressive and terminate fatally as a pneumonia or miliary tuberculosis

The disease with which the surgeon is concerned is usually the result of a second infection Any portion of either lung may be involved The most common sites are the apices the right side being affected more often than the left (Fig 68)

Nature s process of healing a tuberculous cavity is by means of immobilization This brings about some collapse of the affected side of the chest by drawing the ribs together by pulling the diaphragm upward and the mediastinal contents toward the affected side When these natural phenomena can occur satisfactorily the cavity closes spontaneously and becomes obliterated However Nature s efforts may fail because the structures to which the lung is attached by adhesions are unyielding and prevent spontaneous collapse The basis of modern

surgical methods assists Nature to overcome this resistance These methods are referred to under the general terms of collapse procedures.

The medical aspect of tuberculosis and the signs and symptoms of the disease are well known and described in appropriate texts It might be well to emphasize, how ever, that unless the tubercle bacilli are demonstrated one should hesitate to make *a diagnosis of pulmonary tuberculosis, re* gardless of how suggestive the signs and the roentgenograms appear

MEDIASTINUM

The mediastinum is that space which is situated between the lungs It is divided into the superior anterior middle and posterior mediastina The tumors that involve this area have a tendency to be located in specific mediastina (Fig 69) In the anterior mediastinum thyroid enlargements thymomas and teratomas occur The middle mediastinal masses are associated with bron chogenic cysts and esophageal conditions, this particular part of the mediastinum frequently harbors metastatic and tuberculous lymph nodes and lymphomas The posterior mediastinal tumors are predominately neu rogenic.

Tumors

The subject of mediastinal tumors is com plicated because of the large variety of lesions that might occur here Almost any type of tumor can occur in this region Der *moids and the neurogenic neoplasms are* usually malignant. It is impossible to deter mine the exact nature of the growth with out a microscopic study Since the possi bility of malignancy is high and the morbidity and the mortality of exploratory thoracotomy is low there is no justification for permitting mediastinal tumors to remain undiagnosed and untreated The so-called "trial of irradiation is inconclusive and punch" or needle biopsies are to be con demned A biopsy of the scalenus anticus lymph nodes might be helpful A group of cervical lymph nodes is situated on the scalenus anticus muscle If one wishes to avoid an exploratory thoracotomy, exploration of these glands can be done easily (Fig. 70) Fluoroscopy and roentgenography may be helpful Barium studies of the esophagus may reveal an intrinsic lesion or esophageal displacement (Fig 71) Tumors of the *mediastinum are primary or secondary* hence a complete examination and investigation must be conducted

The most common symptom caused by increased mediastinal pressure is *dyspnea* This is probably due to compression upon the large veins and the air passages. The vein that is affected most commonly is the superior vena cava. Obstruction of this vessel results in cyanosis orthopnea, dilatation of the superficial veins of the thorax and the neck and later pleural and pericardial effusions In severe cases of superior caval obstruction there may be headache, dizziness epistaxis and tinnitus subcutaneous edema of the head the neck and the upper part of the thorax may occur also If th obstruction is above the azygos vein orific the symptoms are less severe

Modern thoracic surgery has made possi ble the removal of mediastinal tumors th have not infiltrated. However, mediastin tumors of thyroid origin can still be re moved through the usual thyroidectomy ap proach Median sternotomy gives the be exposure for removal of thymus tumors. neurogenic tumor may have an extensio *into the spinal canal which necessitates* th addition of a laminectomy

Mediastinitis

Infections of the mediastinum compris a wide range of conditions which vary fro mild degrees of inflammation to suppurativ mediastinitis and gangrene These infection can arise from inflammatory or traumati conditions which involve the thorax th abdomen or the cervical region Many acut

mediastinal infections occur from lesions of the esophagus (p 76)

Perforations of the esophagus result from trauma (instrumentation), tumors or inflammatory processes Chronic infections of the mediastinum are often tuberculous in nature they may originate from a tuberculous spine Roentgenography and fluoroscopy are valuable aids

Mediastinal Emphysema

This condition has been described elsewhere (p 50) It produces increased mediastinal pressure

CONGENITAL DISEASES OF THE HEART AND THE GREAT VESSELS

These conditions have become clinically and diagnostically important because tech

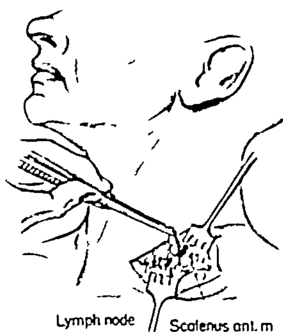


Fig 70 The scalenus biopsy A telltale lymph node may be situated on the scalenus anticus muscle



Fig. 71 Roentgenogram revealing displacement of the esophagus by a mediastinal lymphoma





FIG 72 Congenital diseases of the heart. Examples that are characteristic of each of the 3 groups are shown.

nics have been developed whereby marked improvement or cure may be expected in many of them It is difficult to improve upon the excellent classification proposed by Abbot. She has divided these defects into 3 main groups

1 Cyanotic Group
2 Cyanose Tardive Group
3 Acyanotic Group (Fig 72)

CYANOTIC GROUP

This group is characterized by the presence of a venous-arterial shunt which results in cyanosis of various degrees. A characteristic anomaly of this group is the *tetralogy of Fallot* This is characterized by (1) pulmonary stenosis or atresia (2) interventricular septal defect (3) right ventricular hypertrophy and (4) dextroposition of the aorta The cyanosis is due to a shunting of the blood from the right ventricle to the transposed aorta, retardation of blood flow in the peripheral capillaries and a marked secondary polycythemia If untreated these patients rarely live beyond the twenty fifth year of life, the average age at death being 12 years They present a cyanotic discoloration of the skin, the mucous membranes and the nail beds which becomes more intense upon exertion Their activities are limited by exertional dyspnea. Marked clubbing of the fingers and the toes is usually present. Angiocardiography has been of great diagnostic value Fluoroscopic and roentgenographic examinations reveal a small pulmonary artery and diminution of vascular markings of the lungs The surgical procedures of Blalock and Potts offer hope for this group

Cyanose Tardive Group

This group is characterized by an uncomplicated communication between the systemic and the pulmonary circulations Developmental defects of the cardiac septum result in the formation of interarterial and interventricular septal defects The foramen ovale and the ductus arteriosus may fail to close at or shortly after birth

A **ductus arteriosus** represents the persistence of the left sixth aortic arch This *shunts blood directly* from the pulmonary artery to the aorta A normal ductus ceases to function at or shortly after birth its organic closure is usually complete within a few weeks If a ductus remains patent cyanosis does not occur, because the shunt is directed from the arterial to the venous side However, cyanosis may occur with marked physical exertion (transient cyanosis) The shunt causes increased pressure on the pulmonary artery which results in right ventricular hypertrophy The left ventricle also may be hypertrophied Atheromatous plaques *tend to form in* the pulmonary artery Vegetations associated with subacute bacterial endocarditis frequently occur on these plaques There are 2 serious complications of a persistent patent ductus arteriosus, namely, subacute bacterial endocarditis and cardiac failure These patients are aware of a buzzing sensation in the region of their heart which not infrequently is heard by others standing close by Physical examination reveals a most striking and characteristic machinery like murmur which is continuous and heard best to the left of the *sternum* in the second interspace Both the systolic and the diastolic blood pressures are low Surgical division of the ductus is advocated even in the *presence* of a decompensation or bacterial endocarditis

Acyanotic Group

The *defects of this* group relate themselves to abnormalities that result in the *development* of the sixth pair of embryonic arches Characteristic of this group is *coarctation of the aorta*

Coarctation is a narrowing or obliteration of the aorta which usually occurs just below the origin of the left subclavian artery The aorta and its branches above this constriction are markedly dilated whereas below it they are narrower than normal These patients present *hypertension* in the upper extremities but pulsations in the arteries of the lower extremities are either *diminished or undetectable (hypotension)* Blood does reach those parts of the body distal to the aortic obstruction through a well-developed collateral circulation brought about mainly by the intercostal the internal mammary and the thyrocervical arteries These last vessels become markedly dilated tortuous and elongated The left ventricle is hypertrophied These patients usually die in early adult life from either a rupture of the proximal aortic segment or an intracranial hemorrhage. Headaches and nosebleeds are common A systolic murmur and thrill are present *being of maximum intensity* in the upper back region The roentgenologic findings are characteristic. In the postero-anterior projection a left *ventricular enlargement* and an enlargement of the ascending aorta are seen notching of the inferior borders of the posterior rib segments is pathognomonic. Since the surgical treatment offers great relief or cure early diagnosis becomes mandatory

PERICARDIUM

The common disorders of the pericardium which are of particular interest to the diagnostician and the surgeon are acute pericarditis and chronic constrictive pericarditis

Purulent Pericarditis

This acute condition is encountered most commonly as a complication of a lung infection During epidemics of streptococcal bronchopneumonia purulent pericarditis is not uncommon The serious aspects of this

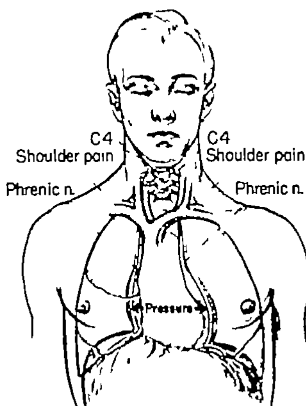


FIG 73 Pericarditis and shoulder pain. When the pericardial sac distends, pressure on the phrenic nerve results this in turn produces pain in the shoulder region

condition are not only those associated with the infection but also the pressure effects caused by the fluid in the pericardial sac these produce a tamponade of the heart The signs and symptoms are associated with precordial discomfort and pain dyspnea and a sense of sternal oppression. The pain usually extends to the left shoulder region (phrenic nerve) (Fig 73) Anxiety, cyanosis and weakened pulse are present often. There is observed frequently an increase in precordial dullness a pericardial friction rub and a palpable liver The roentgenogram may be a valuable diagnostic aid The normal adult pericardial sac holds between 150 and 250 cc of fluid When this amount increases the effects of tamponade become evident. The heart sounds are distant, muffled or even lost The veins in the neck become full and distended and the upper abdomen is tense. If aspiration reveals pus, surgical drainage of the pericardium is indicated

CHRONIC CONSTRICTIVE PERICARDITIS

This disease is characterized by fibrous thickening of the pericardium and the epicardium This condition results from an inflammatory process, but a specific etiology still remains hidden Rheumatic or tuberculous pericarditis has been blamed. In the cases associated with tuberculous infections it seems possible that the spread may be by direct extension from a neighboring tuberculous mediastinal lymph node. The symptoms result from the imprisonment of the heart in a connective tissue shell This prevents the heart from filling in the diastolic phase, the cardiac output is decreased, and the venous pressure is increased. Engorgement of the cervical veins collections of fluid in the peritoneal and the pleural cavities generalized edema and enlargement of the liver are characteristic signs. The roentgenogram shows a heart of normal or slightly smaller size fluoroscopic examination reveals diminished or lack of cardiac pulsations Calcium may be seen in the thickened pericardial sac. Those patients who do not respond to general therapeutic measures should undergo a surgical procedure which consists of a resection of the shell of connective tissue Results from such pericardiectomy and epicardiectomy have been generally good.

DISEASES OF THE ESOPHAGUS

It is incumbent upon every physician to be "esophagus minded" The esophagus is not a mysterious organ and has not received the attention which it warrants The more common conditions to which this organ is heir include congenital defects, diverticula, achalasia, hiatus hernia, varices, inflammatory diseases spontaneous rupture, strictures and tumors.

Congenital Defects

Although numerous congenital defects occur the most common combination is that of esophageal atresia with tracheo-esophageal fistula The most common type of this defect is depicted in Figure 74 These anomalies occur with the same frequency as harelip and cleft palate which is approximately one in every 2 500 births

The clinical manifestations are usually so distinct and uniform that the diagnosis should or can be made within the first few hours after birth The importance of early diagnosis cannot be overemphasized since these children die early from aspiration pneumonia The condition should be suspected if the child is born with a cold, because it would be most unusual for a newborn to present such signs If the child has spells of Choking Coughing and Cyanosis following feedings a diagnosis of tracheo esophageal fistula and esophageal atresia can be made with considerable certainty The diagnosis is verified readily by passing a No 8 F or 10 F soft rubber catheter into the esophagus if an obstruction is encountered the diagnosis of atresia is practically confirmed Lipiodol (never barium) injected through this catheter can be seen on the roentgenogram as it is arrested in the blind end of the proximal esophageal segment If a tracheo-esophageal fistula is also present air is noted in the stomach and the intestine This air is not swallowed but inhaled If no air is demonstrated in the gastro-intestinal tract then esophageal atresia without tracheo-esophageal fistula is diagnosed When the diagnosis is made immediate prep-

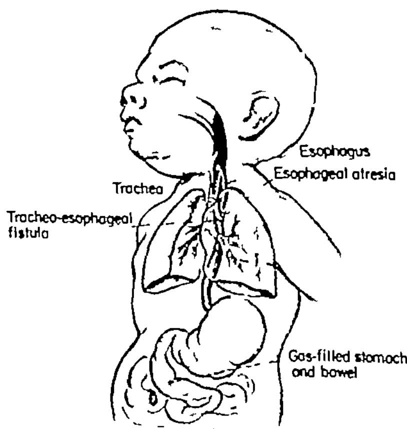


Fig 74 Tracheo-esophageal fistula with esophageal atresia This is the most common type and combination of congenital defect of the esophagus.



FIG 75 Asymptomatic traction diverticulum of the middle of the esophagus discovered in the course of a *routine* roentgenologic examination

aration for surgery is initiated many of these children can be saved It should be emphasized that every 'blue baby' is not a congenital heart lesion

DIVERTICULA

Sites Diverticula of the esophagus usually occur at 3 sites at the pharyngo-esophageal junction, on a level with the bifurcation of the trachea and above the diaphragm (epiphrenic)

The symptoms of diverticula, regardless of their locations, are similar If the diverticulum can empty itself, inflammatory changes do not take place If stasis develops, inflammation and the associated sequelae appear One of the earliest symptoms is difficulty in swallowing or spells of coughing The expulsion of thick mucus or continual clearing of the throat and salivation are particularly significant in the early stage Dysphagia is a later symptom and is caused by pressure of the diverticulum upon the esophagus These patients first have difficulty in swallowing fluids whereas solid foods pass with comparative ease This is in contrast with the patients suffering from tumors who first notice difficulty in swallowing solids Retrosternal pain and a sense of pressure in the neck are frequently present and aggravated by eating Food can be forced back into the mouth by direct pressure upon the affected side of the neck This regurgitated material usually contains food taken at an earlier meal These pouches also may be emptied by postural methods. If stasis is present infection ulceration, hemorrhage perforation and mediastinitis may occur Toxic absorption appears in the late cases and is accompanied by wasting Unusual manifestations are pressure on vessels of the neck pressure on local nerves, alteration in voice and dyspnea Aspiration of retained material has resulted in pulmonary complications and even death from aspiration pneumonia The physical examination is noncontributory unless the pouch is of immense size The diagnosis is made with certainty by means of roentgenography and esophagoscopy Small diverticula frequently occur in the middle of the esophagus and are discovered in the course of routine roentgenographic examinations (Fig 75) They do not require treatment as long as they empty satisfactorily and do not produce pressure.

CARDIOSPASM (ACHALASIA)

Numerous synonyms have been applied to this condition It is characterized by dilatation hypertrophy and tortuosity of the esophagus and a nonorganic obstruction which involves the lower 3 to 6 cm of the esophagus The etiology is unknown This condition accounts for 20 per cent of all cases of dysphagia and is twice as common in females as in males Although more commonly seen in the third and the fourth decades no ages are exempt

Symptoms. The cardinal symptoms are dysphagia retrosternal pain and regurgitation The pain is usually epigastric and may be referred to the xiphoid the precordium the neck the lower jaw behind the ears or between the scapulae (Fig 76) Because of these pain patterns the cardiospasm may be overlooked and mistaken for coronary disease gastro-intestinal conditions or gall bladder infections The pain may be mild or so severe that it requires repeated doses of morphine addiction is not an infrequent sequela Nitrites usually provide relief this is another reason why the condition has been confused with coronary disease and angina pectoris The dysphagia differs sharply from the typical progressive dysphagia of organic stenosis since *in cardiospasm liquids are more difficult to swallow in the early phase than solids* Erroneously the condition has been called globus hystericus because patients complain of a discomfort or "ball" in the throat Characteristic is the fact that solid foods usually must be washed down with large amounts of liquids Because of the difficulty in swallowing and bouts of choking the patient is embarrassed to eat in public or even with relatives and begins to lead a cloistered life The weight may be maintained if he partakes of nourishing

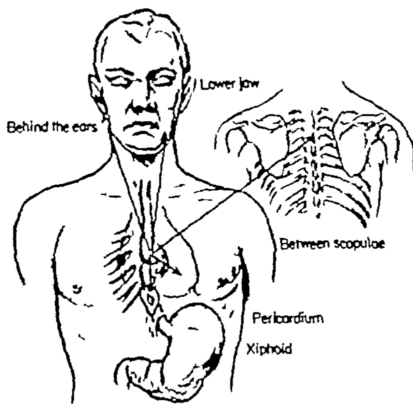


FIG 76 Esophageal pain may be referred to the xiphoid, the pericardium the neck the lower jaw behind the ears or between the scapulae

liquids and semisolids The fact that dysphagia is present with little or no loss of weight speaks against an organic stenosis Nocturnal regurgitation is particularly dangerous, since it can produce aspiration pneumonitis, bronchiectasis and lung abscess The physical examination is noncontributory The roentgenogram reveals the typical defect (Fig 77) Esophagoscopy is indicated particularly to rule out carcinoma Ninety per cent of these patients respond to medical treatment the remaining 10 per cent can be cured by a simple surgical procedure which entails the severing of the muscle fibers at the esophagogastric junction

Esophageal Hiatus Hernia

This is a type of diaphragmatic hernia which is present more frequently than is suspected (Fig 78) The condition is properly referred to as the 'great masquerader" of the upper abdomen since it is readily confused with and must be differentiated from gallbladder disease peptic ulcer, coronary disease and so-called idiopathic secondary anemia The chief symptoms are epigastric distress gaseous eructations, vomiting anemia, hemorrhage dyspnea, weakness and cardiac manifestations The *anemia* calls for special comment. That part of the stomach which is herniated above the diaphragm contains dilated gastric veins that bleed either slowly or massively The reason for the dilated veins is the constriction brought about by the surrounding and contracting diaphragm It should be a general rule that *any patient with an unexplained secondary* anemia should have a careful roentgenographic evaluation this must be done in the Trendelenburg position since this reveals an otherwise reduced hiatus hernia (Fig 79) The treatment is surgical and is quite satisfactory Other types of diaphragmatic herniae will be discussed subsequently (p 84)

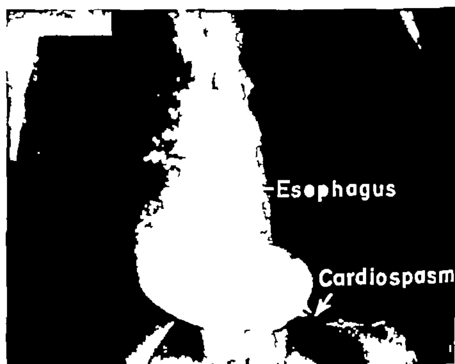


Fig 77 Roentgenogram revealing a typical cardiospasm (achalasia) The nonorganic obstructed area is located at the distal end of the esophagus and proximal to this is the dilated and tortuous esophagus

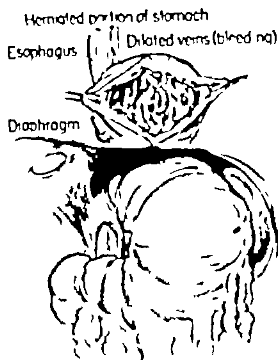


Fig 78 Esophageal hiatus hernia The veins in the intrathoracic part of the stomach dilate and may cause hemorrhage (acute or chronic)

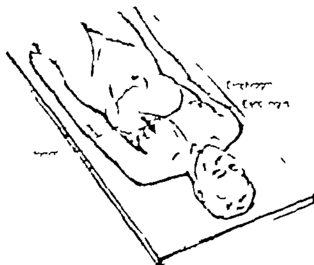


Fig 79 Trendelenburg position will aid in the roentgenographic detection of a hiatus hernia In the erect position the hernia may be reduced and overlooked

Esophageal Varices

Esophageal varices usually result from a portal hypertension (p 181) Although these veins develop silently and insidiously they may rupture and produce an uncontrollable and fatal hemorrhage Banti first called attention to this condition in 1883 it has been referred to as ' Banti s disease Portal hypertension results from intrinsic liver disease or extrinsic portal disease These two types of portal hypertension can be differentiated by the various liver function tests (p 176) If the liver is at fault the tests are positive Esophageal varices are found almost always at the lower end of the esophagus those that are located at the upper end are usually congenital The most common causes are cirrhosis of the liver or thrombosis of the portal vein There are few if any early symptoms of esophageal varices most patients seek medical advice following a sudden massive hematemesis Physical examination may reveal an enlarged spleen (congestive splenomegaly) I have been impressed by the so-called cirrhotic habitus (Fig 181) This is characterized by a male who has little or no hair on his chest The roentgenogram reveals the varices assuming a so-called pearl necklace" appearance (Fig 80) Esophagoscopy, if done must be performed with great caution it is rarely indicated in this condition Blood examination may reveal a secondary anemia, leukopenia and thrombocytopenia

Tumors

Benign tumors are not rare they occur more frequently in males (10 to 1) A wide variety have been encountered the most frequent of which are myomas, fibromas lipomas and polyps Some benign tumors of the esophagus are extramucosal and are covered by normal epithelium These usually arise from the muscle wall

Symptoms The early symptoms are so slight that the patient rarely seeks relief Mild retrosternal pain or an odd sensation in the throat may be so slight that it is overlooked Erroneously such cases may be called "globus hystericus" As the tumor



FIG. 80 Roentgenogram of esophageal varices revealing the so-called "pearl necklace appearance.

grows dysphagia appears and becomes progressively worse If the tumor is pedunculated — and they often are — they may be regurgitated into the mouth and reswallowed (a terrifying experience) In some instances pedunculated tumors have been *aspirated* and cause laryngeal obstruction Roentgenographic and esophagoscopic examinations confirm the diagnosis The results with surgical treatment are most gratifying

Malignant Tumors. Carcinoma of the esophagus *unfortunately is a common disease* The mucosa of the esophagus is squamous in type hence, the lesion is of the squamous (epidermoid) variety Adenocarcinoma is extremely rare and when found usually represents an extension upward from a gastric carcinoma Secondary involvement of the esophagus is uncommon but must be kept in mind in any case of dysphagia It can be embarrassing to resect such a lesion under the impression that it is the primary tumor Secondary involvement arising from the hypopharynx bronchus larynx, stomach breast, testis, pancreas mediastinum and prostate have been reported The history and the symptoms are usually stereotyped dysphagia is the first symptom. It is progressive and relentless Retrosternal pain, loss of weight, signs of dehydration and toxic manifestations appear as the obstruction progresses

The differential diagnosis includes a long list of conditions the most important of which are diverticula, stricture cardiospasm, esophagitis foreign bodies, extrinsic pressure *benign tumors perforating* carcinoma from a bronchus, thyroid enlargements, retropharyngeal abscess granulomatous diseases Plummer Vinson syndrome mediastinal lymphadenopathy esophageal cysts and polyps The roentgenographic examination is a valuable aid however a definite diagnosis is made by esophagoscopy and biopsy With modern surgical methods palliation and occasional cures" can be expected

Spontaneous Rupture of the Esophagus

This condition which formerly was always fatal, has lost some of its horror since an accurate diagnosis, chemotherapy and modern surgical methods can save many of these patients This is particularly true if the diagnosis is made early The esophagus is closely related to the mediastinal pleura

immediately above the diaphragm This portion of the esophagus is weakest and it is here that the increased pressure caused by vomiting or coughing produces the perforation The mediastinal pleura is usually torn The diagnosis should be suspected when the history reveals a sudden onset of severe pain in the chest or the abdomen which usually *follows* vomiting coughing or trauma (In perforated peptic ulcers the pain *precedes* the vomiting) Shock develops rapidly Finding crepitation and emphysema in the supraclavicular regions is particularly suggestive The roentgenogram reveals a hydropneumothorax if the mediastinal pleura is torn Abdominal rigidity which is often present unfortunately calls attention to the abdomen rather than the chest If necessary it is safe to allow a swallow of a nonirritant opaque material to determine the presence of the rupture

ESOPHAGITIS AND PEPTIC ULCER

Esophagitis is probably the most frequent disease of the esophagus Among the etiologic factors are included reflux of gastric secretion hiatus hernia, repeated vomiting, prolonged use of the nasogastric tube and brain tumors The end result of prolonged esophagitis is stricture formation with shortening Dyspepsia is present in about 75 per cent of these patients and the vast majority of them complain of "heart burn" Dysphagia appears later Medical treatment, diet and bougienage usually produce excellent relief Surgery is indicated for the complications of esophagitis

FOREIGN BODIES

Foreign bodies usually are arrested at the 3 physiologic constrictions immediately below the cricopharyngeus muscle in the regions of the arch of the aorta or immediately above the diaphragm Sharp bodies may perforate and produce periesophagitis, mediastinitis and mediastinal abscesses. The symptoms are choking coughing gagging and dysphagia. The patient identifies a painful point which corresponds to the site where the foreign body has perforated or lodged Radiopaque substances are demonstrable on the roentgenogram however should these be nonopaque esophagoscopy is the only definite method of determining their presence and location

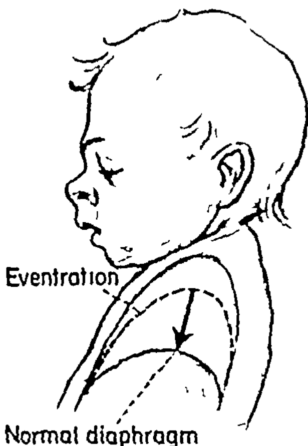


FIG 81 Eventration of the diaphragm.

DIAPHRAGM

The central part of the diaphragm is innervated by the phrenic nerve, afferent nerve fibers enter the third and the fourth cervical posterior nerve roots The peripheral part of the diaphragm is innervated by the lower intercostal nerves and these afferents enter the seventh to the twelfth posterior nerve roots If this nerve pattern is recalled then it is understood that pain from the central portion of the diaphragm is referred to the neck and the upper part

of the shoulder, and pain from the peripheral parts of the diaphragm is referred to the lower thorax the lumbar region and the abdomen Diseases that affect the diaphragm may be congenital neoplastic, traumatic infectious and functional

Congenital Diseases

The clinically important congenital conditions that involve the diaphragm are eventration, reduplication and hernia

Eventration. In eventration the diaphragm is thin and membranous rather than muscular It assumes an unusually high position sometimes reaching the level of the second rib The left hemidiaphragm is involved more frequently The symptoms, if present, are dyspnea flatulence indigestion and constipation This condition is confused with diaphragmatic hernia, but in eventration the abdominal viscera are *below* the diaphragm Pneumothorax or pneumoperitoneum may be necessary if the diagnosis is obscure This is important because eventration rarely demands treatment (Fig 81)

Diaphragmatic hernias may be divided into nontraumatic and traumatic. *Nontraumatic hernias* are essentially congenital and are due to the passage of an abdominal viscus through an opening in the diaphragm (p 80) The *traumatic* varieties may be

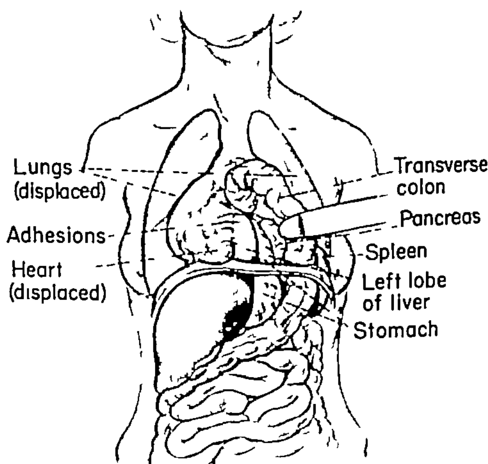


Fig 82 Traumatic diaphragmatic hernia The unusual feature in this case is the presence of the body and the tail of the pancreas in the thoracic cavity The hernia had been present for 2 years, which accounted for the firm adhesions between the left lobe of the liver and the heart.

small penetrating or massive tearing injuries of the diaphragm. The most common symptoms are abdominal pain, dyspnea, dysphagia, vomiting, hemoptysis, cyanosis and pain in the left shoulder. *Change of position frequently alters the severity of symptoms.* Displacement of thoracic viscera is common (Fig. 82). The great danger of diaphragmatic hernia is the possibility of *strangulation*. So-called idiopathic secondary anemia must suggest the possibility of a diaphragmatic hernia (p. 80). Roentgenograms reveal the true condition; they should be taken in the Trendelenburg position.

Tumors

Primary tumors of the diaphragm are exceedingly rare. The benign tumors are frequently asymptomatic and are discovered accidentally. However, bulky tumors interfere with normal diaphragmatic function and cause dyspnea, cough, chest pain and shoulder pain. Pleural effusion may be present.

Infection

Infection in the subdiaphragmatic spaces may necessitate surgical drainage. The author has described 6 subphrenic spaces, each *having a specific surgical approach* (pp. 185-187).

Functional Disturbances

The 2 most important functional disturbances that affect the diaphragm are hiccough and diaphragmatic flutter.

Hiccough (singultus) is paroxysmal clonic contraction of the diaphragm. It is usually mild and innocuous but may be so severe and persistent as to threaten life. It is associated with stimulation of the phrenic nerve: *aneurysm, pleurisy, pericarditis and* mediastinal lymphadenitis may be the source of such stimulation. Also it can be *related to perinephric or subdiaphragmatic* abscess, trauma and hemoperitoneum. It may complicate such diseases as meningitis, encephalitis, cerebral hemorrhage, brain tumor and toxemias. Epidemics of singultus have been reported; these are probably viral in origin.

Diaphragmatic flutter is a rare condition that is poorly understood. It is characterized by a paroxysmal or sustained diaphragmatic contraction with a rate of 60 to 300 per minute. It usually affects both hemidiaphragms. There may be an *antecedent* history of encephalitis or some other nerve condition. It closely resembles coronary disease or angina pectoris, since it is associated with precordial and arm pain. The pain with diaphragmatic flutter is not aggravated by *physical* exertion. Physical examination reveals fibrillary or rapid tremors in the epigastrium. A characteristic to-and-fro shuffling sound, which may be confused with a pleuropericardial friction rub, is heard over the chest. However, this sound is not synchronous with the cardiac cycle but with the diaphragmatic contractions. There may be an associated hyperventilation and respiratory alkalosis.

5

The Breast

EMBRYOLOGY

The milk lines extend from the axillary regions to the pubis and the inner aspects of the thighs (Fig 83) They represent an atavistic throwback Supernumerary nipples and areolae occur frequently on this line Occasionally ectopic nipples and breast tissue occur in such areas as the face and the gluteal regions

The so-called axillary tail of Spence is a prolongation of breast tissue which is situated at the upper end of the milk line and extends into the axilla Frequently it is mistaken for a lymph gland when it is enlarged and painful (Fig 84) This differentiation can be made since the axillary breast tissue

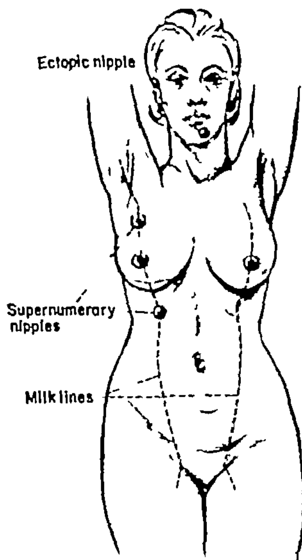


Fig 83 The milk lines These extend from the axillae to the hips. The ectopic nipple on the chin should be noted

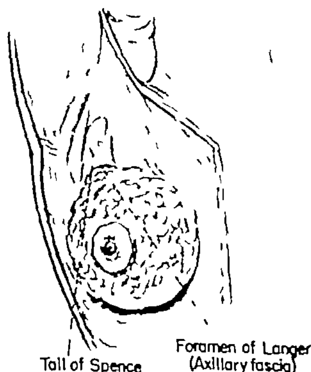


Fig 84 The axillary tail of Spence A prolongation of breast tissue which extends through the axillary fascia (foramen of Langer) Frequently it is mistaken for an axillary lymph gland

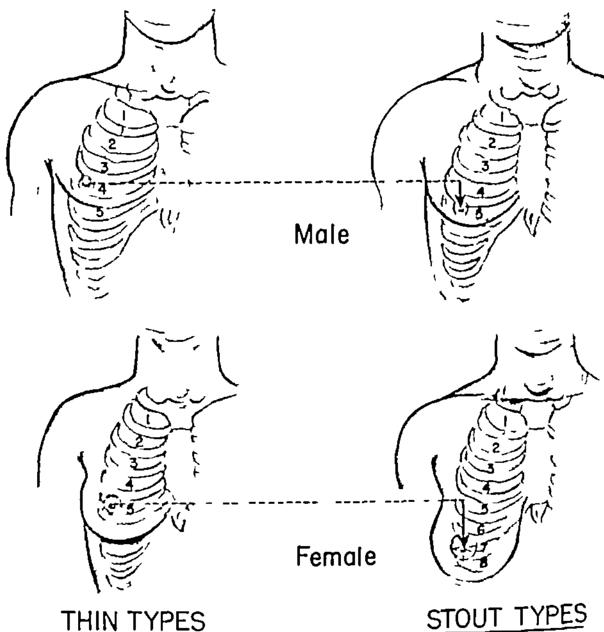


FIG. 85 Normal anatomic positions of the nipples in thin and stout individuals.

enlarges and becomes painful with each menstrual period

EXAMINATION

In the examination of the breast two methods inspection and palpation are particularly helpful

INSPECTION

The physician should record the size and the position of the breasts and the nipples. Also, he should note any changes in contour symmetry and redness. The usual *anatomic position* of the nipple is between the fourth and the fifth intercostal spaces and approximately in the mid-clavicular line this applies to both young males and young thin females (Fig 85) In these types the nipple is an accurate anatomic landmark. With an increase of fat—and at times age—the nipple sags and its position becomes extremely variable In the pendulous breast, (Fig 95) the glandular tissue is at the

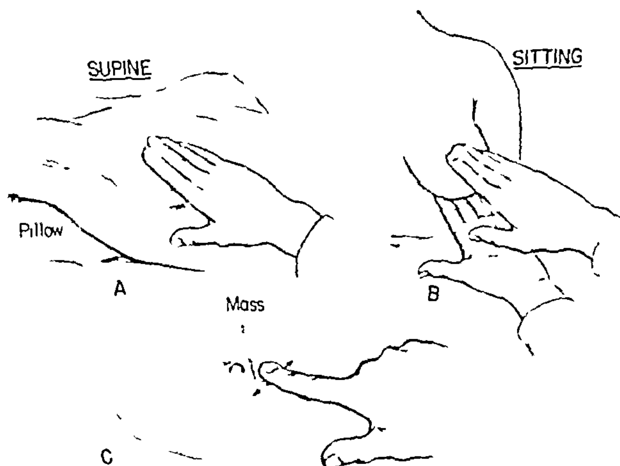


Fig 86 Methods employed in examining the breast

lowest portion of the nipple and the remainder of tissue consists of fat and fibrous tissue

PALPATION

The breasts should be palpated in both the sitting and the supine positions In the supine position the shoulder is elevated slightly by a pillow and the breast is examined *gently* with the flat of the fingers of one hand (Fig 86) It might be helpful while examining the medial portion of the breast to raise the patient's arm above the head but while examining the lateral portion the arms should rest at the side In the sitting position the breast is palpated between the fingers of both hands (Fig 86) This method is particularly helpful in detecting a lesion in the subareolar and nipple regions In this central area the lactiferous ducts converge upon the nipple A tumor situated in the soft subareolar tissue may be impalpable in the supine position but when it is examined with the dependent breast between the examiner's fingers, it becomes readily palpable Also of value in palpation is the method whereby one finger is used to determine fixation and movability of a mass (Fig 86) Pressure against the mass is increased gently and if the lesion is movable or encapsulated it will slip away suddenly and appear to be lost with release of the one-finger pressure it reappears

The *axillary* and the *supraclavicular regions* must be examined individually (Fig 87) The patient should be *sitting* In examining the axilla it is essential that the axillary fascia be relaxed To achieve this the examiner supports the patient's arm on one of his own this will permit palpation along the upper lateral chest wall and well into the apex of the axilla in a search for axillary and apical glands The more gently this palpation is carried out the more re

Supraclavicular fossa

Arm relaxed

A

B

FIG 87 Examination of the axilla and the supraclavicular fossa. (A) The patient's arm is lowered and rests in the surgeon's hand. This relaxes the axillary fascia. (B) the surgeon stands behind the patient as he palpates the supraclavicular fossa.

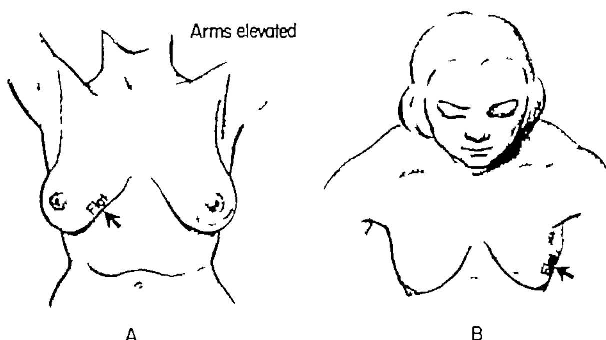


FIG 88 Two simple methods of demonstrating retraction of the skin.

warding will be the information obtained In obese patients axillary palpation is particularly unreliable The supraclavicular regions are conveniently palpated if the examiner stands behind the patient The approximate number of glands consistency and movability should be noted One must remember that palpation cannot determine whether an enlarged lymph gland is inflammatory or metastatic

Retraction Phenomena

Retraction phenomena when present, may be demonstrated easily they are particularly diagnostic since they are suggestive of a malignancy Such findings may be demonstrated when the arms are raised above the patient s head (Fig 88 A) Another way in which retraction can be demonstrated is to have the patient bend forward from the hips with the chin extended upward and the superior extremity extended forward Indentations and flattenings of the otherwise normal spherical contour of the breast immediately becomes apparent (Fig 88 B)

INFLAMMATION OF THE BREAST

Acute Mastitis

This common form of breast inflammation almost always occurs during lactation and suckling It is thought that organisms enter through fissures or openings in the nipple and pass into the breast tissue along the milk ducts The offending organisms are usually streptococci and staphylococci which

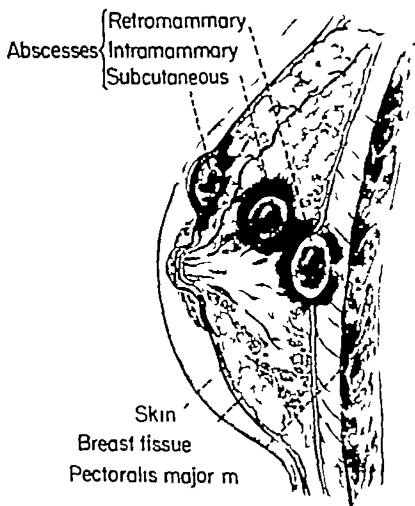


Fig 89 Classification of breast abscesses according to location

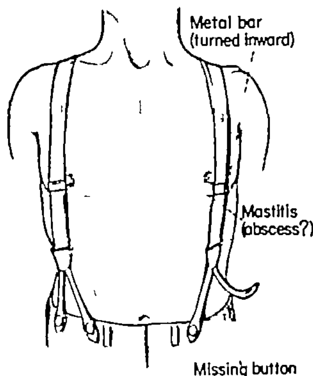


Fig 90 Mastitis (breast abscess?) in the male Frequently this is caused by repeated trauma such as constant rubbing from the metal bar on a pair of suspenders.

may come from the infant s mouth. The affected breast becomes enlarged, firm tender hot and painful If unrelieved systemic signs appear With conservative treatment the inflammatory process may subside completely however this may fail In such instances necrosis and abscesses develop

Breast abscesses may be single or multiple and may be located in one of three places (1) subcutaneous (2) intramammary or (3) retromammary (Fig 89) The clinical signs depend upon the location If the abscess is subcutaneous the inflammatory signs are visible early they appear later if the abscess is intramammary and may be lacking entirely if the abscess is retromammary A septic syndrome is usually present this is characterized by spiking fever true chills marked sweats and a leukocyte count usually over 20 000 It is important to differentiate between acute mastitis and a suppurative process since the former usually responds to conservative treatment but an abscess requires drainage.

This condition may also affect the male breast If so it usually is associated with constant mild trauma such as rubbing Those cases seen by the author are produced almost always by the rubbing of the metal part of a pair of suspenders against the hairy areola This can be greatly exaggerated if one of the suspender pants buttons is missing thereby turning the metal bar inward (Fig 90)

Mammary Dysplasia (Chronic Cystic Mastitis)

Since this condition is neither always cystic nor inflammatory, it is best that the time-honored name of "chronic cystic mastitis be replaced by the more nearly accurate term "mammary dysplasia." Experimental and clinical data strongly support ovarian dysfunction as the principal cause of this condition

The estrogens (ovarian follicular hormones) affect the growth of mammary epithelium The administration of estrogen in infants being treated for gonorrheal vaginitis results in temporary mammary growth when given to adult females the breasts become enlarged The human breast, so treated, reveals many forms of epithelial growth which include adenosis, cystic disease intraductal papillary growth and possibly carcinoma. When estrogens are administered to adult males epithelial proliferation occurs Development of carcinoma of the male breast associated with long-continued estrogenic treatment for prostatic carcinoma has been reported. Mammary dysplasia can be divided into three types (Fig 91) (1) mastodynia (2) adenosis and (3) cystic disease

Mastodynia. This is the most common of the 3 forms of mammary dysplasia It is characterized by breast pain and tenderness which is most marked in the premenstruum. The upper outer quadrant of the breast is involved most frequently It may be unilat

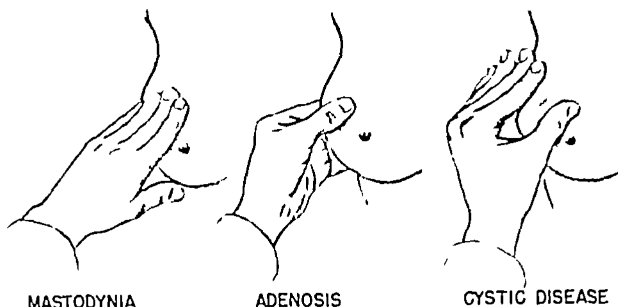


FIG 91 Mammary dysplasia is a more appropriate term than the misnomer "chronic cystic mastitis" Three types of this dysplasia are recognized mastodynia, adenosis and cystic disease These are endocrine disturbances which must be differentiated from carcinoma The saucerlike edge of adenosis is characteristic.

eral or bilateral The pain is mild in character in the early stages but ultimately becomes more severe and prolonged In the chronic cases it may persist throughout the greater part of the menstrual cycle Weight of excessively heavy and pendulous breasts increases the discomfort Physical examination reveals a tender, firm and somewhat granular area of breast tissue which the patient refers to as a lump" The fear of carcinoma brings her to the physician The swelling is usually larger and more painful before each menstrual period This cyclic association with the menses cannot be over emphasized as a diagnostic aid for all types of mammary dysplasia. Demarcation from surrounding breast tissue is usually indistinct.

When such breast tissue is seen on cut surface the area is usually white fibrous not encapsulated and at times associated with tiny cysts The indurated areas tend to disappear after pregnancy and the menopause If the cases persist they are prone to develop adenosis Therapy consists of mental as well as breast support

Adenosis This has been referred to as Schimmelbusch's disease It is fortunately the least common form of dysplasia since it is the most serious type It is seen most frequently in women between the ages of 35 to 45 and is characterized by the presence of nodules in one or both breasts In most instances the patient is aware of a distinct nodule which usually occurs in the upper outer quadrant of the breast The majority of patients are childless seem to be of a nervous type and frequently have irregular menses Exacerbation of pain and enlargement of the nodule are commonly found during the premenstrual period These nodules reveal a definite edge which is readily felt at the periphery The induration suggests malignancy The condition usually persists for years About 4 per cent of these cases are associated with intraductal papillomas and bleeding from the nipples

The differential diagnosis between adenosis and carcinoma may be very difficult Statistical data show an incidence of carcinoma in patients with adenosis of approximately 4 per cent The particular reason for

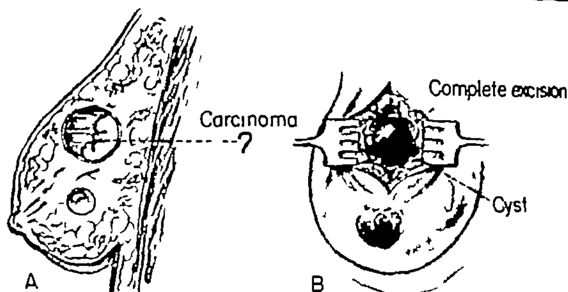


FIG 92 Cystic disease of the breast (dysplasia) Because of the possible association of carcinoma these cysts should be excised and not aspirated.

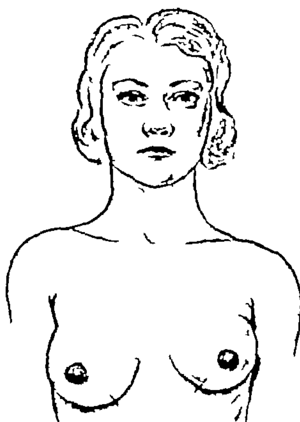


FIG. 93 Prepubertal enlargement in the developing female breasts. The resulting asymmetry should cause no alarm since the condition almost always rectifies itself

the extreme difficulty in the differentiation is because of the gradations of the two diseases which dovetail Biopsy is the only certain method of determining the nature of the lesion In those patients who become pregnant disappearance of the nodularity and tenderness usually occurs after mid-pregnancy and the breasts become normal during lactation It is interesting to note that some breasts which previously have been the seat of adenosis appear to be normal a year or more after childbirth.

Cystic Disease of the Breast. This condition has been referred to as the cystic disease of Reclus or the blue dome cyst of Bloodgood This type of dysplasia is characterized by the presence of one or more cysts which occur during or near the menopause The peak of the age incidence is between 40 and 45 years it is unusual to find macrocystic breast disease under the age of 25 Authorities have found evidence to support the probability that an intense and unopposed estrogenic stimulus results in cyst formation

The patient consults a physician when she discovers a "lump" about one *half of these* are associated with pain and/or soreness. The cysts may change in size or disappear

abruptly The mass feels smooth rounded tense and freely movable (Fig 86) Transillumination may be helpful at times If the cyst is situated deep in the breast and lies close to the chest wall its nature and extent will be difficult to appraise Multiple cysts are found in one or both breasts in approximately 25 per cent This tendency toward multiplicity and bilateral involvement suggests an endocrine imbalance At times there is a serous discharge from the nipple

During surgical exploration the cyst is found to have a tense thin wall with a distinctive bluish tint the latter being lost when the cyst is opened The fluid is usually serous or cloudy and the wall is smooth and glistening Intracystic papilloma and carcinoma cysts must be considered first in the differential diagnosis It is true that these latter conditions occur after the menopause as a rule and frequently affect the large ducts in the areolar area whereas the cysts in the macrocystic disease per se usually occur during the menopause and affect the smaller ducts Nevertheless such differentiations are too difficult to make hence no time should be lost in excising these masses for thorough microscopic study (Fig 92) If the pathologist has the slightest doubt regarding a frozen section he should not be pressed for a snapshot diagnosis It is better and safer for everyone concerned to await the study of the paraffin sections Aspiration of cysts of the breast should be condemned (p 103)

Two groups of cysts that are not associated with mammary dysplasia are galactoceles and sebaceous cysts The former results from an obstructed duct (usually during lactation) and the latter resemble sebaceous cysts seen elsewhere in the body

ABNORMAL BREAST ENLARGEMENTS

These may be prepubertal or postpubertal

Prepubertal Enlargements

Between the ages of 10 and 12 years it is not unusual to discover a rather marked asymmetry of the developing breasts (Fig 93) This should cause no alarm, since in almost each instance the condition rectifies itself

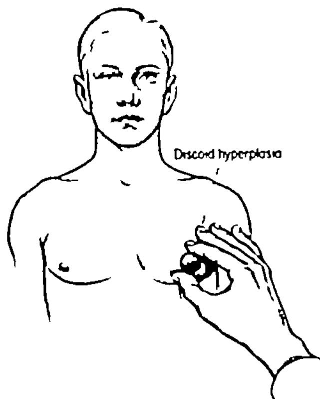


Fig 94 Prepubertal enlargement in the developing male breast This is known as discoid hyperplasia, it requires no treatment and disappears spontaneously

In boys there may be an enlargement beneath the areolae of the developing breasts (Fig 94) The firm mass feels like a disk about the size of a quarter and is often tender It has been referred to as *discoid hyperplasia* These should be left alone since they regress spontaneously

Postpubertal Enlargements

The normal adult female breasts are slightly asymmetrical In some instances both breasts become massively enlarged producing the condition known as *virginal hypertrophy* The cause of this condition is unknown These patients complain of excessive weight and pain particularly during the premenstruum The author has seen the

skin of the shoulders grooved so deeply by the weight of the breasts that the brassière straps caused severe dermatitis and even bleeding Such breasts can be corrected by plastic surgery (Fig 95)

In men, between the ages of 45 and 65 abnormal enlargement of one or both breasts may develop (Fig 96) The lesion resembles those seen in boys at puberty, namely, a firm discoid mass beneath the areola which at times is tender It is important to remember that *gynecomastia* may be related to cirrhosis of the liver tumors of the testicle tumors of the adrenal cortex and pituitary tumors Of particular interest is the enlarged male breast seen in liver cirrhosis with its increased susceptibility to carcinoma Carcinoma forms a painless hard irregular mass which is abnormally fixed to surrounding structures and associated with signs of retraction If the slightest doubt exists as to the nature of the lesion excision and microscopic study should be done

BENIGN TUMORS OF THE BREAST

Although not all inclusive a practical classification based upon the type of tissue from which the tumor arises includes the following (Fig 97) (1) fibroadenoma, (2)

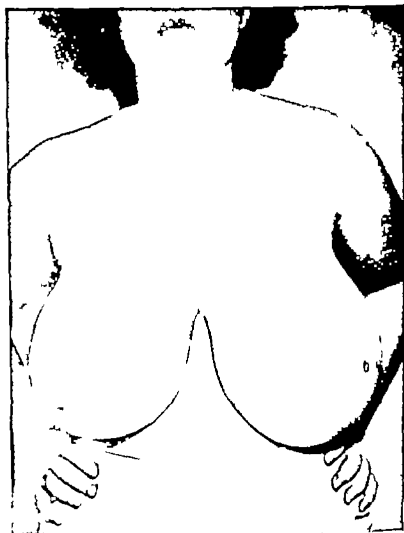


FIG 95 Virginal hypertrophy is a postpubertal enlargement.

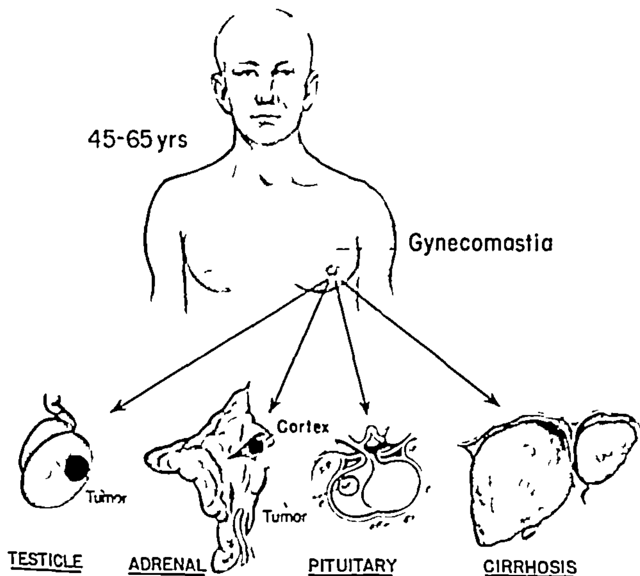


Fig 96 Postpubertal gynecomastia This condition may be associated with tumors of the testicle the adrenal or the pituitary A thorough study of the liver also must be conducted because of the frequency with which gynecomastia is related to cirrhosis and other liver diseases

intraductal papilloma and (3) miscellaneous tumors lipoma angioma etc

Fibroadenoma

This is the most common benign tumor of the female breast Though it may be encountered in all age groups it is found most commonly during the third and the fourth decades It has a tendency to enlarge during pregnancy The symptoms are usually insignificant although slight pain may be present Usually the mass is discovered accidentally by the patient while bathing or dressing Of diagnostic importance is the observation that the size remains stationary The average fibroadenoma ceases to grow after attaining a size of 2 to 4 cm in diameter

Physical examination reveals a palpable smooth firm nodule which slips about readily beneath the examining fingers (Fig 86) This extreme mobility is an important point in differentiating it from malignant tumors

Pathologists divide them into 2 types intracanalicular and pericanalicular

BENIGN TUMORS

Fibro-adenoma

Intraductal papilloma

Misc
Lipoma
Angioma
etc.

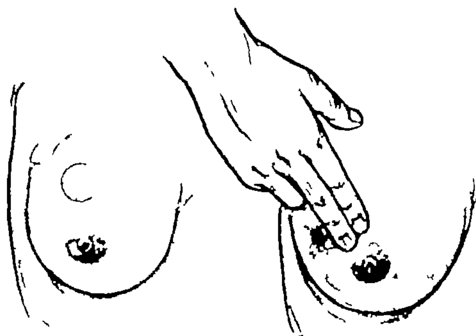


FIG 97 A practical classification of benign breast tumors.

Since one can arrive at a correct diagnosis only by microscopy these lesions should be excised and studied.

Intraductal Papilloma

As the name implies this is a papillomatous growth of epithelium into the lumen of a duct. They usually occur singly and are located in the ampulla or close to it they have been known to form in a pre-existing cyst.

In contrast with other tumors they are frequently so small that they are not palpable Occasionally however a thickened duct or tiny nodule can be felt immediately beneath the nipple Almost always pressure *directly over the papilloma* will result in extrusion of a small drop of serous or bloody fluid (Fig 98) They are the most frequent cause of bleeding from the nipple. When these papillomas are large enough to be palpable they are apt to be undergoing malignant transformations It is well to remember that whereas these tumors are located beneath the nipple the fibroadenomas are rarely seen in this location.

Other Forms

Other benign tumors (lipoma angioma, etc.) which may affect the breast resemble tumors found elsewhere in the body, they are mentioned for the sake of completion.

CARCINOMA OF THE BREAST

The etiology of carcinoma of the breast is unknown there appears to be some relationship to the female sex hormones Direct trauma stagnation and heredity as etiologic factors also have their proponents It is more common in nulliparous women and appears to be less frequent in women who have suckled their young The term "precancerous" lesion is a misleading one In this respect all breast lesions may be considered as precancerous to quote Stewart the female breast is a precancerous organ

Classification

Frequently classification of tumor results in clinical dilemmas When the weary clinician reads such terms as "encephaloid," "medullary" "carcinoma simplex" "scirrhus" or "adenocarcinoma, he may be left in a quandry Encephaloid merely means resembling brain Medullary suggests resembling marrow Carcinoma simplex implies "simple" carcinoma but nobody ever would consider carcinoma simple Scirrhus means hard Adenocarcinoma is a rather futile term since the breast is a gland, and every carcinoma derived therefrom is fundamentally an adenocarcinoma Qualified pathologists have taught us that different parts of a given tumor may show different structural arrangements

Numerous classifications can be found and consulted in any standard textbook of surgery or pathology Of greater clinical and prognostic importance however is the simple classification of (1) infiltrating and (2) noninfiltrating

If a tumor has broken through the normal anatomic boundaries and has invaded the surrounding lymph and blood vessels the prognosis is worse One might find some clinical value in classifying these tumors as being intraductal or extraductal Some pathologists are of the opinion that "grading" carcinoma is of little or no value when it pertains to the breast in contradistinction to "gradings" which appear to have prognostic value when pertaining to the skin and the cervix uteri It is well to recall that those tumors that attain large sizes usually remain confined to the breast for longer periods of time.

Lymph Drainage

Numerous descriptions have been pre-

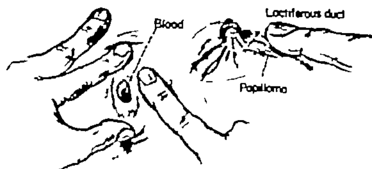


Fig 98 Intraductal papilloma The location of the papilloma can be determined if the surface of the breast is spread out and if pressure is exerted in the direction of the nipple with the index finger placed at the periphery of the areola. This is repeated around the areola A drop of blood will appear at a duct opening on the nipple when the papilloma is pressed.

sented of the lymph nodes and drainage that are associated with the mammary gland These may be found in any standard text.

After studying lymph drainage and the paths that spreading carcinoma may take, one is reminded of the terse statement of the late Dr Richard Jaffe who said Who am I to tell carcinoma where to go? Metastases may appear in most bizarre and remote locations

Breast carcinomas vary widely in their clinical courses In younger individuals they usually spread more rapidly Masses in the medial portion of the breast are particularly prone to spread to the opposite breast and the lymph nodes associated with it. Extension may take place via peritoneal lymph channels and thence to the liver Frequently the lungs and the bones are affected the bones that usually are attacked are those which contain red marrow namely ribs, skull, vertebra, pelvis and proximal ends of the femurs (Fig 99)

Clinical Manifestations

These can be remembered if one recalls

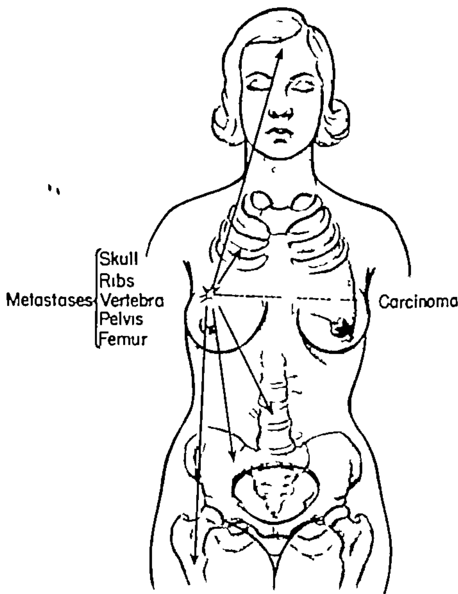


Fig 99 The bones which most frequently reveal metastasis in carcinoma of the breast.

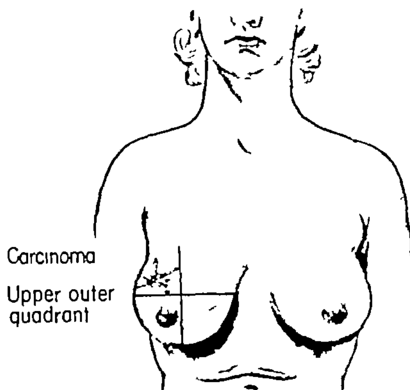


FIG 100 The upper outer quadrant of the breast is involved most frequently by carcinoma.

the letters and the spelling of the word BREAST

Breast mass
Retraction signs
Edema
Axillary involvement
Sanguineous nipple discharge
Tenderness

The mass may be located in any portion of the breast however it is found most frequently in the upper outer quadrant (Fig 100) Usually it is discovered accidentally by the patient while bathing or dressing Its consistency is firm to hard and its margin is ill-defined It does not have the free mobility of benign tumors or cysts The greatest of gentleness must be exercised in palpating these lesions

Retraction signs can be demonstrated by dimpling of the skin and/or retraction of the nipple (Fig 88)

Dimpling of the skin is a most valuable sign (Fig 101) It is produced by invasion

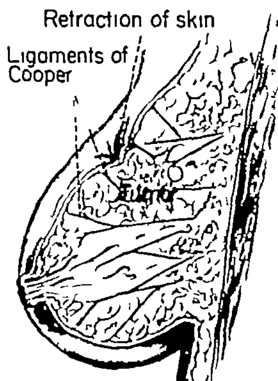


FIG 101 Retraction of the skin is caused by invasion and contraction of the ligaments of Cooper

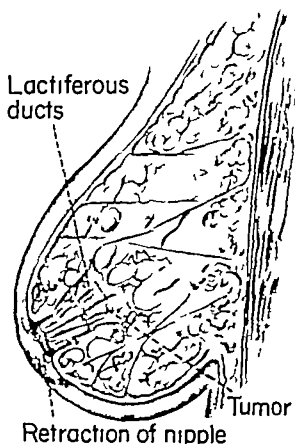


FIG 102 Retraction of the nipple is caused by invasion fibrosis and contractions of the lactiferous ducts The tumor is located directly beneath the nipple.



FIG 103 Edema of the breast gives a characteristic "pitting" The fixation of the hair follicles and the sebaceous glands accounts for this.

of the ligaments of Cooper by cancer cells These ligaments are bands of fibrous tissue which anchor the breast to the overlying skin and the pectoral fascia. Following invasion, the ligaments contract and account for the dimpling and the fixation either to the skin above or the pectoral fascia below The sign although very helpful, is not pathognomonic since it may be found in other conditions particularly those associated with previous breast operations acute mastitis fat necrosis and plasma cell mastitis. In the first two conditions the differentiation is easy since the history is so informative however the differential diagnosis between carcinoma and fat necrosis taxes the experience and the ability of the most seasoned physicians and is frequently impossible until the tissue is excised and examined

Retraction of the nipple is present when the tumor is located beneath the nipple (Fig 102) It is due to extension of the growth along the lactiferous ducts with subsequent retraction and fibrosis. It must be recalled that retraction of the nipple may be congenital and may be bilateral.

Edema accounts for the 'orange peel" or pigskin" appearance of the breast. It results from obstruction of the lymphatics by the neoplasm (Fig 103) The hair follicles and the sebaceous glands are more firmly fixed to the subcutaneous tissue than the

rest of the skin The skin around these openings bulges forward when the lymphatic drainage is interfered with, and the hair follicles appear as depressions in the edematous area Since this sign may be produced by acute inflammatory conditions it cannot be considered as pathognomonic of carcinoma

Axillary metastases (p 90) It is difficult to determine whether enlarged glands are inflammatory or neoplastic These glands should be examined microscopically, as they may be of some value prognostically

Bloody discharge from the nipple is a frightening discovery for the average woman (Fig 104) Nipple discharge occurs in less than 5 per cent of the cases of carcinoma of the breast and in about half of these the discharge is serous and not bloody Benign lesions produce a nipple discharge. It is not pathognomonic for carcinoma.

Tenderness is more common than pain In a fairly high percentage of patients the tenderness of the carcinoma leads to the discovery of the mass Pain uncommon in carcinoma of the breast is associated with the

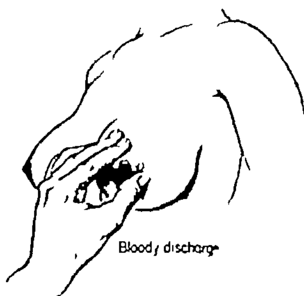


FIG 104 Bloody discharge from the nipple is suggestive but not pathognomonic of breast carcinoma

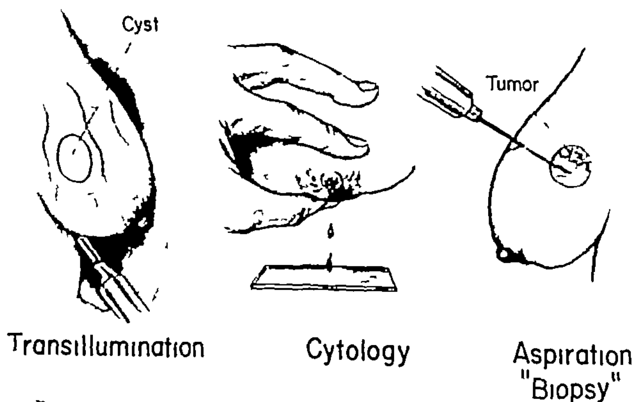


FIG 105 Some methods used as diagnostic aids in diseases of the breast These are mentioned only to emphasize their extreme limitations (see text)

late phase of the disease Pain in the back and the extremities should make one suspect bone metastases *Cough* suggests pulmonary metastases

Cancer of the breast during *pregnancy* and *lactation* grows more rapidly and has a grave prognosis *Carcinoma en cuirasse* is observed when the skin involvement is more rapid than that of deeper structures The surface then presents a nodularity that is diagnostic. So-called *inflammatory*" cancer of the breast is a rapid-growing neoplasm that is associated with infection The hyperemia and skin thickening may be so marked that it is mistaken for erysipelas These cases usually take a rapidly fatal course

Diagnostic Examinations

Biopsy suggests the removal of a small amount of tissue for study Such a piece of tissue should *not* be removed when it is possible to excise the entire mass. Although in most instances a frozen section will reveal the diagnosis there are cases that cannot be diagnosed by this method. In such instances one must await a more thorough microscopic study made from paraffin sections

Needle and *punch biopsies* are mentioned only to be condemned (Fig. 105) They traumatize and may miss or disseminate the tumor A cyst associated with a tumor might reveal the fluid but miss the neoplasm

Cytologic examinations are not as useful in studies of nipple discharges as in vaginal and cervical smears or material taken from the respiratory tract.

Transillumination is limited in its usefulness as is mammography

SARCOMA OF THE BREAST

This is a rare disease its incidence being placed at 0 5 per cent Numerous types have

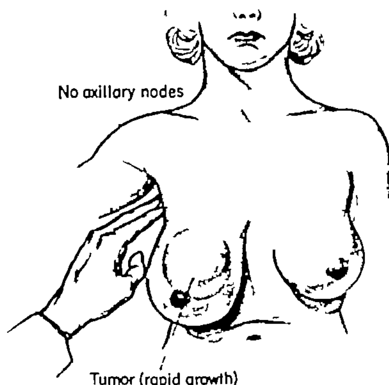


Fig 106 Sarcoma of the breast grows rapidly and rarely involves the axillary lymph nodes early

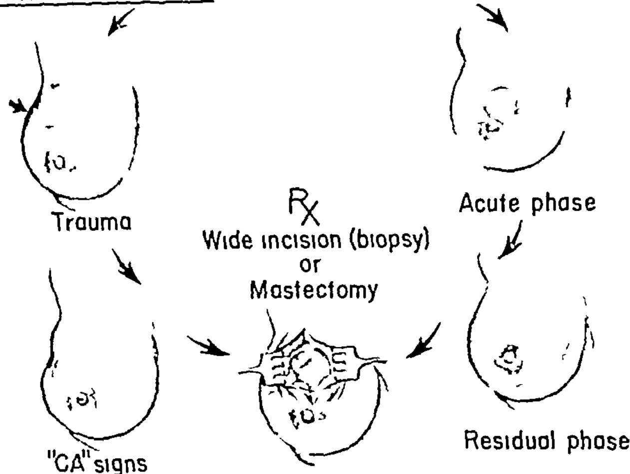


Fig 107 Differential diagnosis of carcinoma of the breast Two conditions—traumatic fat necrosis and plasmas cell mastitis—may resemble a malignant neoplasm of the breast. The relationship of the lesion in plasma cell mastitis to the nipple should be noted.

been described the most common being fibrosarcoma and spindle cell sarcoma At times the condition develops from a preexisting fibroadenoma

The two important features in the diagnosis are the rapid rate of growth (the tumor may reach the size of a grapefruit within a few months) and the absence of involved axillary lymph nodes (Fig 106) There is a tendency toward ulceration The prognosis is variable because of the great variety of sarcomas The angiosarcomas are highly malignant whereas the so-called cystosarcoma phyllodes is relatively benign

PLASMA CELL MASTITIS

The etiology of this condition is unknown The disease presents two phases (1) The *acute phase* consists of a mild inflammatory reaction that is associated with local heat, redness and tenderness This phase is a transient one the symptoms subside spontaneously following a rather mild course for which the patient rarely seeks medical advice (2) After some weeks or months the *residual phase* appears (Fig 107) Examination now reveals a firm mass usually not tender and possessing an irregular ill-defined border The importance of plasma cell mastitis lies in the fact that it is confused with carcinoma because it may present "orange peel" skin retraction of the nipple, discharge from the nipple and enlarged axillary lymph nodes The signs of local inflammation are *entirely* lacking in this stage so that the eliciting of a history that reveals a

previous mild acute phase is extremely important in the differential diagnosis The final diagnosis rests with a histologic examination

TRAUMATIC FAT NECROSIS

This condition is characterized by a lump in the breast which originates from the destruction and the necrosis of fat with subsequent inflammation and fibrosis A history of trauma cannot always be elicited but when present is of such severity as to produce a painful tender mass that is accompanied by ecchymosis (Fig 107)

The disease is found most commonly in obese women between the ages of 30 and 60, since in the latter decades of life fat has a tendency to increase in the mammary glands Although it is not common it is important because it is difficult to differentiate from carcinoma.

The necrosis results from a response of the body to the chemical irritation of fat and its decomposition products (fatty acids and glycerol) These products set up an inflammatory reaction ultimately followed by the deposition of dense, firm, scar tissue

Only a small percentage of contusions of the breast result in fat necrosis since the majority heal without sequelae In those cases that develop fat necrosis the original pain tenderness and discoloration disappear within 2 or 3 weeks and the mass decreases in size Rarely does the mass disappear entirely It may take several months or years for the development of the dense fibrous tissue When this latter stage appears it is practically impossible to differentiate it from carcinoma There is usually definite fixation of the mass to the skin which gives rise to retraction of the skin as seen with malignancies "Orange peel" skin rarely appears in fat necrosis and retraction of the nipple is extremely uncommon Axillary lymph nodes may be present

Wide excision of the mass with thorough microscopic study is the only way in which a definite diagnosis can be made.

TUBERCULOSIS OF THE BREAST

This condition is quite rare and usually affects young women. Active lesions elsewhere in the body may or may not be demonstrable The condition develops slowly with relatively little pain. It appears as a nodular mass fairly well localized at first but later involving the entire breast The diagnosis is suspected if sinuses develop. Culture material from these may be helpful. Microscopic examination of tissue usually reveals tuberculosis It may resemble carcinoma in many respects and the differential diagnosis can be quite difficult.

SYPHILIS OF THE BREAST

This condition may be encountered in its primary secondary or tertiary stage The primary stage manifests itself as a chancre of the nipple the secondary stage consists of skin reactions tertiary stage gummas are rare It is the tertiary lesion that must be differentiated from a neoplasm.

ACTINOMYCOSIS OF THE BREAST

This also is a rare condition. When found *it is usually secondary to* pulmonary actinomycosis which has broken through the thoracic wall and extended to the breast. At first firm nodules appear which become fixed to the skin these finally form sinuses. It is prior to the sinus formation that these nodules simulate carcinoma. The diagnosis is confirmed by the finding of sulfur granules and the ray fungus.

PAGET'S DISEASE OF THE BREAST

Sir James Paget described (1874) a series of cases which were characterized by eczematoid lesions involving the nipple and the areola breast carcinoma followed within a year or two Later other investigators discovered large hydropic cells in the epidermis of these lesions which they called "Paget's

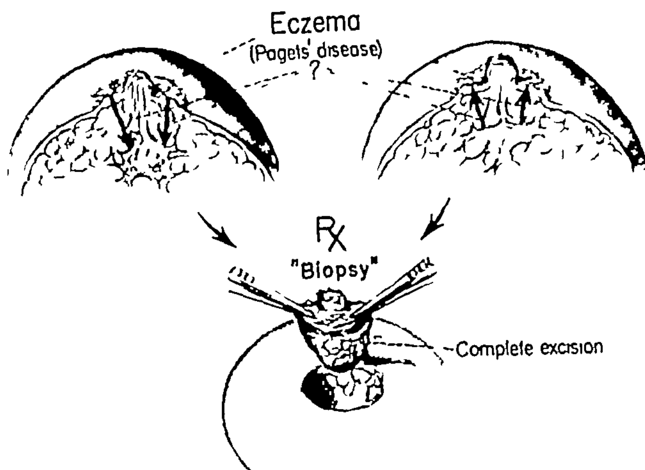


Fig. 108 Paget's disease is still not completely understood Whether it originates in the nipple as an eczema and extends downward as a malignancy or vice versa is still moot.

cells." An erroneous conclusion resulted, since it was thought that such cells were pathognomonic of Paget's disease or breast cancer It is known today that these cells are found in many skin lesions that are benign

Experts differ regarding Paget's disease One group is of the opinion that the disease originates in the nipple or the areola, becomes malignant and then extends downward to involve breast tissue secondarily Another group adheres to the teaching that this condition is primarily a carcinoma of the breast which originates in the subareolar region and later involves the nipple secondarily (Fig 108)

Clinical Manifestations

The patient usually complains of itching and burning over an eczematous patch this is accompanied by a constant weeping surface The exudate is usually serous but may be bloody Scabbing and crusting result in the formation of fissures Ulceration develops and retraction signs appear late It is notoriously true that in a large percentage of cases no underlying mass is felt However when a mass is palpable it has all the characteristics of a carcinomatous growth

Treatment

It is agreed by most authorities that the nipple, the areola and the subareolar breast

tissue should be removed en bloc (Fig 108) This removes the entire involved area and affords adequate tissue for biopsy study In the event that the lesion is benign no future therapy is indicated however, if a malignancy is discovered mastectomy is indicated How radical such mastectomies should be is still debated by experts

6

Esophagogastro-intestinal Tract

ESOPHAGUS

It is advantageous to consider an esophagogastro-intestinal tract rather than a gastro-intestinal tract. Many conditions that involve the lower end of the esophagus are frequently confused with lesions of the stomach and the bowel. These include cardiospasm, carcinoma, ruptured esophagus, diverticula, varices, esophagitis and esophageal ulcers. They have been discussed elsewhere (pp 76-83).

STOMACH

The more common conditions which affect the stomach are gastritis, peptic ulcer and its complications, tumors, acute dilatation, foreign bodies, specific granulomas and infantile pyloric stenosis.

Gastritis

Gastritis or inflammation of the gastric mucosa occurs frequently. If it is present in a subclinical state it is not a surgical problem. However, *two forms* of gastritis are of surgical importance; these are chronic atrophic gastritis and chronic hypertrophic gastritis.

Chronic atrophic gastritis is of importance because of the possible relationship between it and gastric carcinoma. Fortunately, it presents certain pathologic characteristics which make it a recognizable entity. The involved area of mucosa is gray and flat and is covered with an excessive amount of mucus. Although it might affect any part of the stomach, the antrum usually is involved. Its symptomatology varies greatly. The patient may have few or no complaints and the disease may be found coincidentally. Mild dyspepsia or epigastric distress might lead to an erroneous diagnosis of gallbladder disease, ulcer or carcinoma. At the operating table the surgeon may demonstrate a mucosa that is difficult to diagnose; however, microscopic study reveals an atrophy of the mucous membrane.

Chronic hypertrophic gastritis usually presents more severe symptoms. In its focal form it is often confused with benign polyps. In its diffuse form it must be differentiated from multiple polyposis, infiltrating carcinoma and lymphosarcoma. The rugal folds may become so enlarged that they resemble the convolutions of the brain. The epigastric distress can be severe; curtailment of food results in weakness and loss of weight.

Hemorrhage is particularly common; this fact has not been stressed sufficiently. The hemorrhage may be small in amount and chronic; this type is associated with severe secondary anemia. At times the hemorrhage may be acute and alarmingly massive. This type must be differentiated from hemorrhage associated with ulcers and varices.

Fluoroscopy and possible gastroscopy are of great value in diagnosing chronic hypertrophic gastritis. The symptoms may be so severe as to require gastric resection. The milder forms of the disease respond favorably to appropriate medical therapy. If the condition cannot definitely be differentiated from infiltrating carcinoma and lymphosarcoma, exploratory laparotomy becomes mandatory. The author has been particularly impressed with the value and the ease of gastrotomy. This permits careful inspection

of the interior of the stomach and the removal of sections for microscopic study

Gastric Ulcer

Most gastric ulcers are located in the pyloric region or along the lesser curvature Ulcers on the greater curvature are almost always malignant Statistical data regarding malignant degeneration of these ulcers give a sense of false security If every gastric ulcer is considered a malignancy until proved to be otherwise many lives will be salvaged

Gastric and duodenal ulcers differ in many respects

Gastric Ulcer	Duodenal Ulcer
1 Etiology apparently associated with a hormone secreted in the antrum of the stomach	1 Etiology apparently associated with the neurogenic (vagus) phase of secretion
2 Not related to hypersecretion and hyperacidity	2 Closely related to hypersecretion and hyperacidity
3 Potentially malignant	3 Rarely if ever malignant
4 Recurrence rate following adequate surgical therapy is low	4 Recurrence rate following adequate surgical therapy is relatively high
5 Treatment is preferably surgical	5 The treatment is preferably medical

To treat a gastric ulcer medically places a tremendous responsibility upon the attending physician

The typical ulcer story is described elsewhere (p 115) In brief it may be stated here that these patients complain of a burning or gnawing epigastric distress which appears a few hours after meals and is relieved by vomiting alkalies or the intake of food. The symptom pattern of the gastric ulcer patient is a little less definite than that of the duodenal ulcer The complaint of "dyspepsia (heartburn gas eructations) is probably the most common one Diagnosis is aided by means of fluoroscopic roentgenographic and at times gastroscopic examinations Studies of gastric acidity are of limited value and are not pathognomonic. One must be particularly mindful of those gastric 'ulcers which respond both clinically and radiologically to medical management and return some months later with a far-advanced malignant lesion at the site of the ulcer '

The complications of gastric ulcer which are similar to those of duodenal ulcer are discussed on page 116

Benign Tumors of the Stomach

These tumors produce clinical manifestations sufficient to warrant surgery in only 1 to 2 per cent of cases. Most frequently they are polyps or leiomyomas.

The polyp is usually a well-formed rounded mass which varies in size, it may be sessile but usually presents a clearly differentiated head and stalk. It is definitely movable The common secondary changes are inflammation, ulceration and hemorrhage Diagnosis usually is made by roentgenologic or gastroscopic examinations or surgery In patients with multiple polyps the exact number or locations can be determined only by gastrotomy Since they might undergo malignant degeneration, their identification is important

Carcinoma of the Stomach

Over 30 000 lives are lost annually in this country as a result of gastric carcinoma. It is the most common malignant tumor in males and is nearly as prevalent in females as carcinoma of the uterus or the breast. Although it is encountered most frequently in the fifth and the sixth decades of life, it is seen all to frequently in the fourth and the third decades Cases have been reported under 20 years of age It is clinically "silent" for a considerable length of time metastases are present in at least 50 per cent of patients by the time their first symptoms appear

When a *"change of habit"* occurs in any organ or system in the body carcinoma must be *considered until proved to be otherwise*

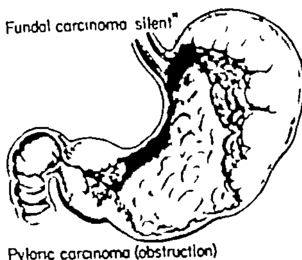


FIG 109 Carcinoma of the stomach The tumor manifests itself earlier when it involves the pyloric end because it causes obstruction A tumor at the fundal end of the stomach may reach huge proportions before producing clinical manifestations.

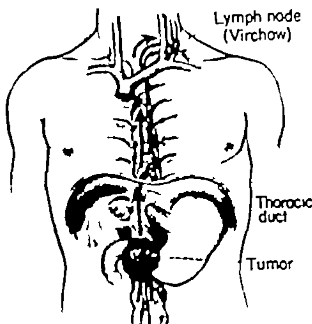


FIG 110 Virchow s node This is an involvement of the lymph glands in the left supraclavicular space frequently associated with carcinoma of the stomach.

The stomach is no exception to this rule these patients become aware of a change in their eating or digesting habits Such a patient becomes stomach conscious " Although gastritis peptic ulcer, gallbladder disease—to mention only a few—may produce this "change of habit carcinoma must be the first condition to be ruled out Epigastric distress anorexia nausea or vague abdominal complaints if unexplainable and persistent beyond a period of a few weeks, require exhaustive study A tumor at the pyloric end will produce earlier symptoms because it obstructs however in the fundus the neoplasm may become very large before it manifests itself (Fig 109) The fundal carcinoma is fortunately the rarer type because of its chronicity anemia may be the outstanding and only feature The presence of "coffee ground" vomitus is evidence of ulceration and bleeding associated with gastric retention When the mass is palpable in gastric carcinoma the lesion is usually far advanced and often inoperable Anemia and loss of weight are *late* manifestations

A filling defect is the significant roentgenologic finding Of limited value is the examination of the gastric contents which may show blood lactic acid anacidity and sarcinae People with apparently normal stomachs may have little or no gastric acid and patients with gastric carcinoma have been known to have hyperacidity

The tumor may spread by direct contiguity into surrounding structures or it may spread by lymph vessels blood vessels, or gravity It is unfortunate that carcinoma of the stomach is notorious for the frequency with which metastases are present at the time of surgical exploration Of particular serious prognostic importance is the finding of a left supraclavicular lymph node known as Virchow's sentinel node (Fig 110) As the carcinoma spreads through the muscularis and involves the serosa of the stomach widespread secondary peritoneal implants may develop The ovaries are particularly receptive to such cells Such "gravity' or dropped metastases may form pelvic masses which are detectable on rectal and

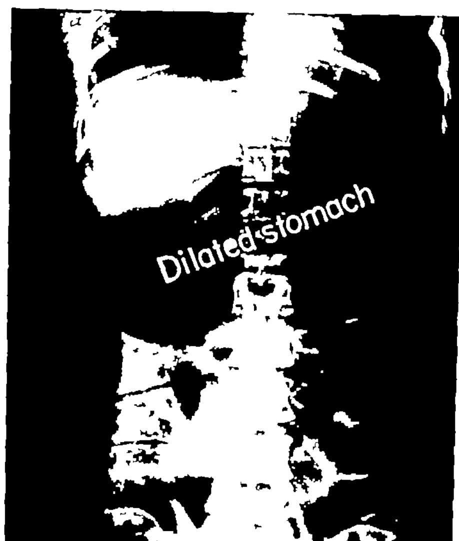


FIG 111 Roentgenogram of acute gastric dilatation. The subdiaphragmatic air is postoperative

vaginal examinations Blood born metastases may appear in remote parts of the body

Sarcoma of the Stomach

This tumor constitutes about 1 per cent of all gastric malignancies like carcinoma it is observed more frequently in males *Lymphosarcoma* is the most common type of gastric sarcoma The clinical picture is similar to carcinoma Microscopic examination reveals the true nature of the lesion The differentiation between carcinoma and sarcoma of the stomach is important since the prognosis in a well localized sarcoma is much more favorable than carcinoma

Syphilis of the Stomach

This disease may produce symptoms and roentgenologic findings similar to those of cancer or peptic ulcer The differentiation becomes particularly difficult when a patient with a gastric ulcer has a positive serologic response

Foreign Bodies in the Stomach

This condition is encountered frequently Most objects that pass the mouth can be passed per rectum however they require constant observation with serial fluoroscopic and roentgenologic examinations *If the object is sharp and periodic roentgenologic examinations reveal that it has become stationary exploratory laparotomy is indicated* *Food balls* represent a type of foreign body they develop from tough vegetable fibers particularly persimmons They are referred to by the general term of bezoars. Bezoars of vegetable origin are called phytobezoars and those of animal origin (hair) are known as trichobezoars Roentgen examinations after ingestion of barium reveal their presence

Acute Dilatation of the Stomach

This change occurs as a postoperative or post traumatic complication particularly when peritonitis is present The entire stomach becomes dilated with liquid and

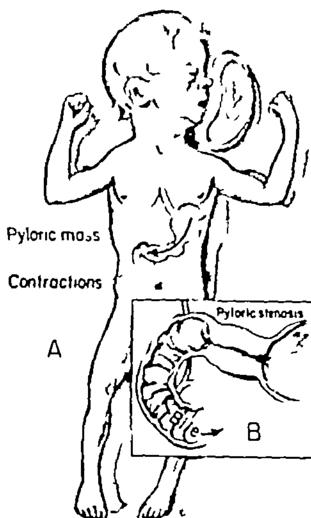


Fig 112 Infantile pyloric stenosis. (A) Hyperperistaltic contractions passing from left to right and a palpable pyloric mass are characteristic. (B) The emesis is not bile-stained, since the obstruction is complete and proximal to the ampulla of Vater

gas and produces upper abdominal distention (Fig 111), if marked, such distention results in cardiorespiratory embarrassment Pain is not a predominant symptom but continuous vomiting produces rapid deterioration Hiccough is a frequent symptom Diagnosis is simple if the condition is kept in mind Nasogastric siphonage results in deflation and immediate relief

Infantile Pyloric Stenosis

This condition is encountered in well developed first born male infants (7 1)

The first 2 or 3 weeks of life are usually uneventful, and then without warning or apparent cause the child begins to vomit This becomes progressively worse until little or nothing is retained Emaciation oliguria obstipation and alkalosis result If untreated, death occurs before 3 months of age as a result of starvation or complicating pneumonia

Physical examination usually reveals vigorous gastric peristaltic waves which pass from left to right across the upper abdomen and terminate under the right costal margin (Fig 112) In this latter area one can frequently palpate a firm olive-shaped (pyloric) mass The vomitus does not contain bile since the obstruction is complete and proximal to the ampulla of Vater (Fig 112B) A roentgenogram reveals a large dilated stomach (Fig 113) fluoroscopy indicates the degree and the completeness of the pyloric obstruction

Heredity plays an important role in the etiology of this condition but its exact nature is unknown

Microscopically the mass consists of hypertrophied muscle involving the circular coat. The longitudinal muscle contributes little to the mass, and there is no significant increase in fibrous tissue The muscle mass reaches its maximum firmness between the fourth and the ninth weeks of life and then with gradual stretching of the serosa it becomes progressively softer This coincides with the clinical observation that if a child can be maintained in good general health with medical treatment beyond 3 months of age he is likely to recover without having to resort to surgical intervention

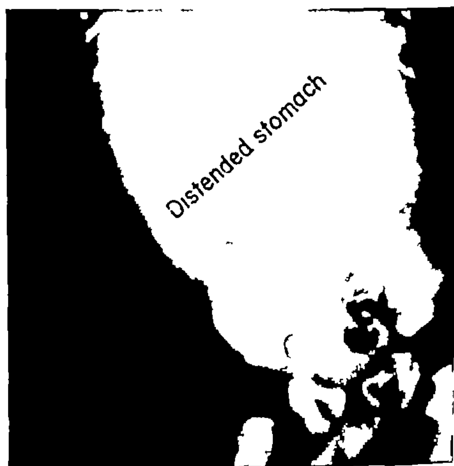


Fig 113 Roentgenogram of an infantile pyloric stenosis.

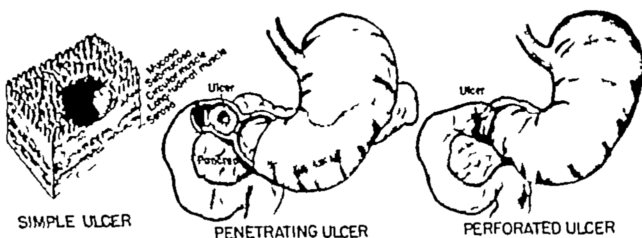


FIG 114 Peptic ulcers may be simple penetrating or perforated (see text)

DUODENUM

DUODENAL ULCER

Incidence This is a common disease It has been estimated that from 5 to 10 per cent of our population is affected with this lesion Some authorities are of the opinion that it is related to the increased tension of modern life Men are afflicted more frequently than women peptic ulceration occurs more frequently in the duodenum than in the stomach (5 to 1) It usually appears in the third or the fourth decades, is worse in the spring and the fall and at times of great mental stress and following infections. It is associated with remissions and exacerbations so that in the symptom free period the patient believes that he is cured

Symptoms A typical story is usually elicited When the patient awakes following some hours of sleep his pain is not present this is believed to be due to the fact that his secretion acidity and gastrointestinal activity are diminished The pain appears between breakfast and lunch Rarely is it unbearable and has been described as burning gnawing or a 'hunger pain It is relieved by one of 3 things food alkalies or vomiting It recurs some hours after lunch, usually between lunch and dinner and appears again between dinner and bedtime Frequently these patients are awakened by the pain after a short sleep they retire with milk or food at their bedside to relieve such distress Heartburn and eructations, although present are not characteristic since they occur in many other conditions If vomiting is present early in the course of the disease it probably is due to edema or pylorospasm if it occurs later it is due to scar tissue (organic obstruction)

Examination. Physical examination may reveal tenderness deep in the epigastrium presumably over the lesion Superficial tenderness or hyperasthesia is due to referred pain A study of gastric contents is of some value because with duodenal ulcer there is usually a hyperacidity and hypersecretion The roentgenographic examina tino usually reveals the ulcer which is located most frequently in the first part of the duodenum.

Types A *simple* peptic ulcer is one that has eroded or involved only the mucosa and has not involved the deeper layers (Fig 114) A *penetrating* ulcer is one which involves the deeper layers and penetrates into an adjacent organ These usually are located at the posterior aspect of the first part of the duodenum they attack the pancreas Because the pancreas seals these ulcers, they rarely perforate A *perforating*

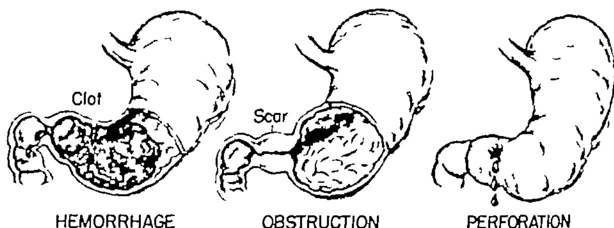


Fig 115 Complications of peptic ulcers. Malignant degeneration, a fourth complication applies almost entirely to gastric ulcers.

ulcer is one which is not protected by an adjacent viscus and is perforating into the peritoneal cavity These ulcers are usually on the anterior gastric or duodenal wall if untreated they will perforate into the peritoneal cavity Clinically penetrating and perforating ulcers differ from simple ulcers in 3 ways in that the pain becomes continuous, is far more severe and is difficult to relieve Those ulcers which penetrate posteriorly into the pancreas usually are associated with pain in the region of the ninth to the eleventh dorsal vertebrae Tenderness is most marked in the perforating variety Roentgenologic examination reveals the lesion Such lesions have been known to perforate while under the fluoroscopic screen hence caution is the key note

Complications of Peptic Ulcers

The 3 most important complications are hemorrhage obstruction and perforation (Fig 115) Combined they appear in serious forms in about 5 to 10 per cent of all peptic ulcer patients They are present in both gastric and duodenal ulcers Carcinoma is a fourth complication but applies almost entirely to gastric lesions (p 110)

Hemorrhage. Bleeding from peptic ulcers may be mild moderate or massive The term massive is applied to those cases that present a sudden loss of at least 1 liter of blood clinical manifestations of shock, and anemia associated with a red blood cell count below 2.5 million per cu. mm are usually present These patients vomit bright red blood or pass tarry black blood per rectum. The vessel that is usually involved is the gastroduodenal artery Abdominal auscultation is helpful since the bowel sounds are increased with intraintestinal hemorrhage However, in intraperitoneal hemorrhage the abdominal sounds are diminished or absent (Fig 116)

If the patients are in a younger age group (under 45 years) atheromatosis is usually not advanced the elastic blood vessels contract and control the hemorrhage If the patient is older the sclerotic vessels are unable to contract, and the bleeding usually continues. Massive bleeding from gastroduodenal ulcers must be differentiated from bleeding anywhere in the esophagogastro-intestinal tract Although bright red blood passed per rectum usually means lower (colon) intestinal bleeding, peptic ulcer bleeding also may produce bright red blood in the stool because of the associated hyperperistalsis. This is the exception and not the rule.

Inspection reveals marked pallor Pain is almost always absent and there are no signs of peritoneal irritation The blood counts,

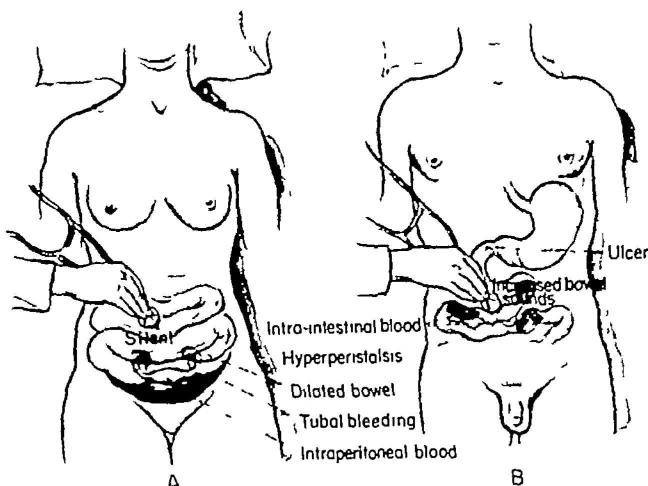


FIG. 116 Intra intestinal or intraperitoneal hemorrhage? (A) In intraperitoneal bleeding (regardless of cause) the bowel sounds are diminished because of the dilated bowel which results from the chemical peritonitis (B) In intra intestinal bleeding the bowel sounds are hyperactive because of the blood-filled gut.

hematocrit and hemoglobin determinations are helpful but are not as significant particularly regarding the progress of the case as are the blood pressure and the pulse

Obstruction. As pyloric obstruction develops, vomiting increases and becomes the outstanding symptom Little or no relief is obtained, and eating usually aggravates the distress Gastric ulcers located in the pars media produce an hourglass contracture and obstruction (Fig 117) Dehydration, emaciation and electrolytes imbalance develop rapidly The vomitus contains undigested food if bile is absent after repeated bouts of vomiting the obstruction is complete It may be difficult to determine how much of the obstruction is due to scar tissue spasm or edema A therapeutic test of conservative therapy may be tried This consists of frequent feedings alkalies, antispasmodics and nasogastric siphonage If retention diminishes after such treatment part of the obstruction was due to edema and spasm

Perforation This usually appears with dramatic suddenness. It occurs more frequently in males A previous ulcer history is usually present Following the ingestion of a meal, the patient experiences a pain so severe that he doubles up or 'falls to the floor" At no time in his life has he experienced a pain of such severity *Prostration* is present. This should not be confused with shock, which is unusual in these cases

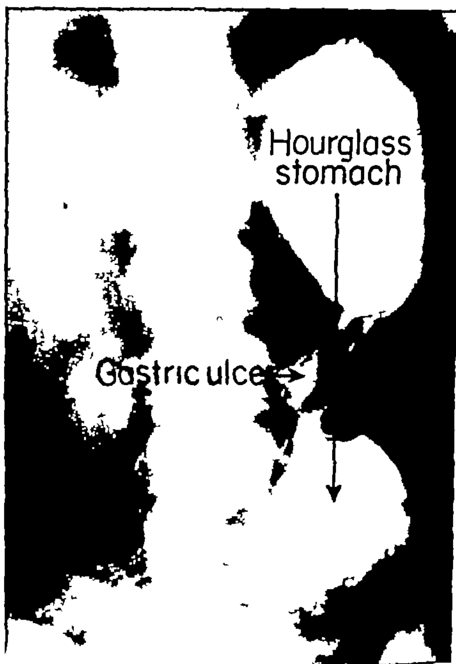


FIG 117 Roentgenogram of an hourglass contracture of the stomach resulting from a gastric ulcer

Although the patient is bathed in a cold sweat and the extremities are cold and clammy, *the pulse and the blood pressure remain normal*. The patient has an anxious pale expression and the respirations are shallow and rapid. The reason for this type of breathing is that it is almost entirely thoracic without an abdominal component.

When a patient states that he does not wish to move or to be moved one must suspect *peritonitis*. If the patient requests the driver of the auto or ambulance to "drive slowly and take the bumps easily," he has peritonitis. The patient with *colic* is usually restless *and seeks relief by moving about*; this is diametrically opposite to the patient with peritonitis who wishes to be perfectly quiet (Fig. 249).

Abdominal rigidity in all 4 quadrants is present and is boardlike. Tenderness is intense, particularly over the ulcer site. Abdominal auscultation is very helpful, since almost every patient with a perforated peptic ulcer has a *silent abdomen*.

A spontaneous pneumoperitoneum is present in about 75 per cent of these patients (Fig. 118). The presence and the visualization of free air in the peritoneal cavity indicates a perforation of a hollow viscus, not necessarily a perforated peptic ulcer. However, if there is an antecedent peptic ulcer history, the diagnosis of a perforated peptic ulcer is almost a certainty. The air bubble will be seen as a translucent area on the right side as it separates the diaphragm and the right lobe of the

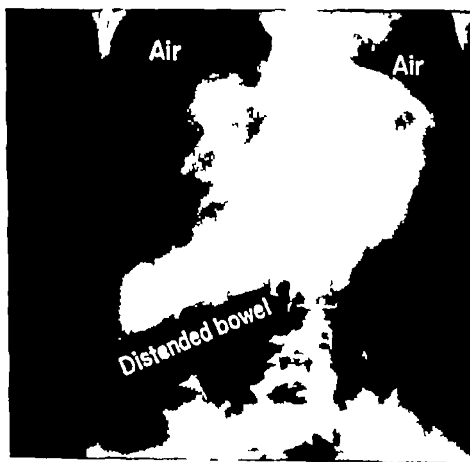


Fig. 118. Roentgenogram revealing a spontaneous pneumoperitoneum in a case of perforated peptic ulcer. These pictures must be taken with the patient upright or on his left side to permit the air bubble to "float up" and separate the right hemidiaphragm from the right lobe of the liver.

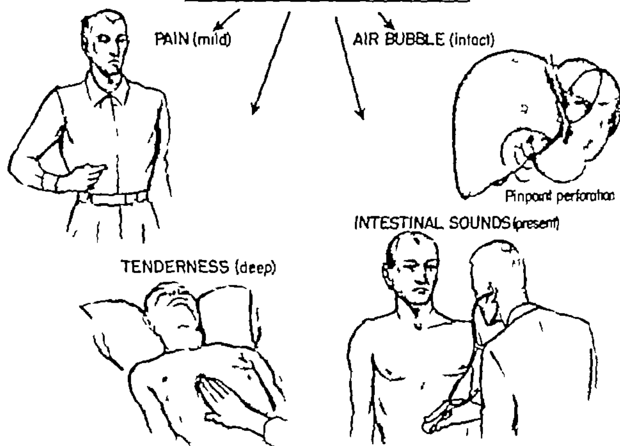


FIG 119 The *forme fruste* ulcer This pinpoint perforation seals off rapidly and produces minimal peritoneal signs. Therefore, it is easily overlooked The patient has mild pain and is not prostrate but ambulatory the tenderness is absent or deep, the bowel sounds are present and a spontaneous pneumoperitoneum is not demonstrated on the roentgenogram

liver In the upright position air may be seen under the left hemidiaphragm this may be confused with the normal intra gastric air bubble. If the air under the left hemidiaphragm is free intraperitoneal air the thickness of the diaphragm is less than a quarter of an inch whereas if it is gastric air the thickness includes both the diaphragm and stomach wall and appears to be thicker

Obliteration of liver dullness can be demonstrated by percussion if a large amount of intraperitoneal air is present

Forme Fruste Ulcer

This is a pin point perforation that is sealed rapidly The rapid closure is brought about by plugging of the perforation or obliteration by the under surface of the liver or by gallbladder Since the perforation is small and the sealing rapid, the leakage is minimal. The peritoneum usually can cope with a small amount of soiling which is chemical and relatively sterile hence the clinical manifestations are minimal or absent (Fig 119) The patient may walk about, pain is slight, tenderness is absent or deep the bowel sounds are usually present and the spontaneous pneumoperitoneum (air bubble) is lacking These are the cases that are most likely to escape detection Patients with this type of perforation re perforate with their next meal. With the second perforation the classical

picture usually becomes manifest Perforated peptic ulcer may be confused with appendicitis (p 120) when the upper abdominal pain shifts to the right lower quadrant Such shifting in perforated ulcers is due to the gravitation of escaped duodenal or gastric contents along the paracolic gutter of the ascending colon The contents pool around the appendiceal area and produce a serosal appendicitis (Fig 120) These patients have right lower quadrant or McBurney point tenderness Such errors should be infrequent if the physician recalls that the patient with a perforated peptic ulcer is much sicker has tenderness along the entire paracolic gutter absence of bowel sound air in the peritoneal cavity and usually an antecedent ulcer history

Occasionally a perforated peptic ulcer is seen in infants The etiology is unknown

DUODENAL DIVERTICULUM

These diverticula are present in from 2 to 5 per cent of all persons past 50 years of age The exact cause is unknown but there

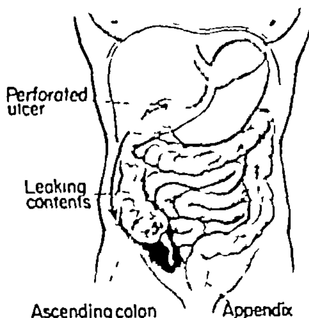


FIG 120 Acute appendicitis or perforated peptic ulcer? These two conditions may be confused because leaking contents from the ulcer may pool around a normal appendix producing a "serosal appendicitis"

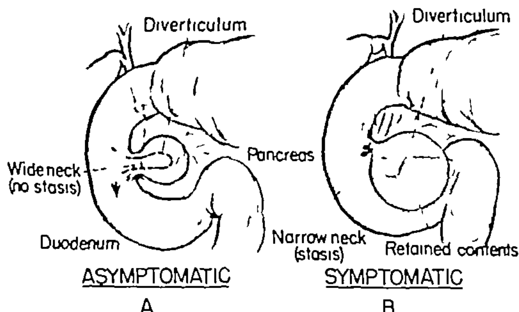


FIG 121 Duodenal diverticulum (A) If the neck of the diverticulum is wide contents may enter and leave without producing stasis (B) If the neck of the diverticulum is narrow gastro-intestinal contents become entrapped and produce stasis which in turn results in inflammation and its sequelae.



FIG 122 Roentgenogram of a diverticulum of the descending part of the duodenum (A) The narrow neck of the diverticulum should be noted. (B) Retention of barium in the diverticulum 24 hours after ingestion of the meal

is general agreement that a point of weakness is present where blood vessels nerves and ducts enter and leave the bowel The frequent occurrence in the second part of the duodenum particularly about the ampulla, is believed to be due to a weakness of the wall caused by the passage of the common bile and pancreatic ducts at this site (Fig 121) The diverticulum may vary in size from the size of a pea to that of a pear It is characteristically ovoid in shape The vast majority project from the concave aspect of the duodenum in the second the third and the fourth portions

No characteristic symptoms exist The condition may be symptomless and found coincidentally in the course of a roentgenologic examination Symptoms if present may mimic those of gallbladder or gastric diseases The most common symptom is pain or discomfort of varying intensity in the region of the upper abdomen usually the right upper quadrant or the epigastrium It is usually related to the intake of food A change in position may bring about drainage and relief Also attributable to duodenal diverticulum is melena hematemesis diarrhea and nausea It remains for careful roentgenologic study to demonstrate the lesion (Fig 122) A 4- or 6-hour retention film is of value to determine the presence or the absence of *stasis* The symptoms of the diverticulum are due to distention, pressure or mechanical interference. Inflammation occurs with stasis this results in diverticulitis with its associated sequelae of erosion, hemorrhage perforation and peritonitis

Malignancy in a duodenal diverticulum has been reported

TUMORS

Benign tumors are uncommon the most usual types being leiomyomas lipomas and polyps Primary carcinoma of the duodenum is rare As the tumor enlarges, the symptoms produced are not unlike those of carcinoma of the pyloric end of the stomach (p 110) Roentgenologic investigation permits detailed study of the lesion.

AMPULLA OF VATER

This area of the duodenum is important because carcinoma occurs here with relative

frequency Obstructive jaundice is usually the first if not the only sign or symptom to appear This requires differentiation from a stone in the common duct a stricture of the common duct and a carcinoma of the head of the pancreas (p 203) Since the pancreatic duct also opens at the ampulla the pancreatic digestive enzymes may be absent in the intestinal tract also This results in pancreatic insufficiency which can be diagnosed when the feces reveal undigested striated meat fibers This indicates an absence of the proteolytic enzyme trypsin (Fig 123) Continuous but slight bleeding may be present hence melena is a common manifestation At times the hemorrhage may be massive A careful roentgenologic study of the duodenum particularly in its descending portion where the ampulla is located may reward the clinician in making as early a diagnosis as possible

FOREIGN BODIES

Foreign bodies in the duodenum usually pass The old teaching that anything that passes by mouth will pass per rectum is usually correct If the object is sharp it may penetrate anywhere along the esophago gastro intestinal tract straight firm objects such as nails cannot get around the duodenojejunal bend It is imperative therefore that the progress of foreign bodies be studied by repeated roentgenologic or fluoroscopic examinations If an object remains stationary usually for 24 hours and if tenderness is present at the foreign body site surgical removal becomes necessary

JEJUNO ILEUM

DIVERTICULA

Diverticula of the jejuno-ileum if asymptomatic are discovered by the radiologist They can produce symptoms ranging from

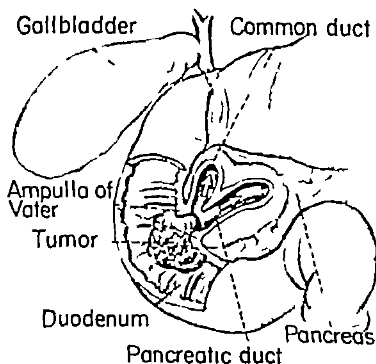


FIG. 123 Carcinoma of the ampulla of Vater A relatively small tumor at this site can obstruct the common bile duct and the pancreatic duct This results in obstructive jaundice and pancreatic insufficiency

vague epigastric distress to severe intestinal bleeding They are easily overlooked at the operating table because they are hidden within the leaves of the mesentery There fore, they should be sought on the mesenteric side of the bowel (Fig 124) In this way they differ from diverticula of the large bowel which are found along the antimesenteric border (p 142)

Any patient suffering from epigastric distress or *gastro-intestinal bleeding,* in whom the commoner esophagogastro-intestinal diseases have been excluded should be examined for such diverticula Careful roentgenologic study following the progress of the barium meal at half hour intervals can be most rewarding Symptoms may be due to mechanical pressure or to inflammatory changes (diverticulitis) and its complications

Meckel's diverticulum is considered *separately because of its relative frequency* and specificity It is a remnant of the obliterated vitelline duct of embryonic life (Fig 147) The proximal part of the duct that enters the primitive gut fails to become completely obliterated and forms this pouch.

The author has found it helpful to discuss this entity as the "disease of 2 s" (Fig 125) It is found approximately in *2 per cent* of all individuals it favors males *2 to 1* it is *2 feet* away from the ileocecal valve it is usually *2 inches* long it is confused with 2 surgical conditions namely appendicitis and peptic ulcer it may contain one of 2 types of ectopic tissue gastric or pancreatic, and *is associated with 2 complications* (hemorrhage and perforation) The condition may be symptomless or act as any other diverticulum in that a variety of symptoms may be produced by it It predisposes to intussusception, torsion, or bands which lead to intestinal obstruction When a Meckel's diverticulum is found in an inguinal hernial sac it is known as a *Littre's hernia* (p 239)

Regional Enteritis (Crohn's Disease)

This is a mysterious and remarkable disease. It was described as a clinical entity by Crohn Ginzburg and Oppenheimer in 1932, Although many theories exist as to its causes nothing definite has been established.

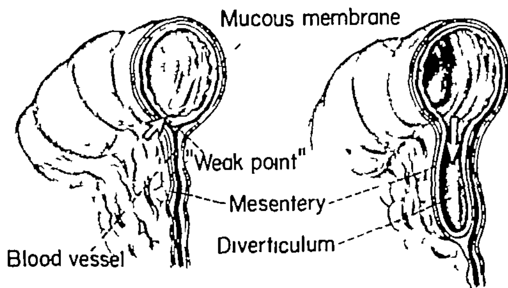


Fig 124 Jejuno-ileal diverticula These are easily overlooked at the operating table because they are located and hidden within the leaves of the mesentery

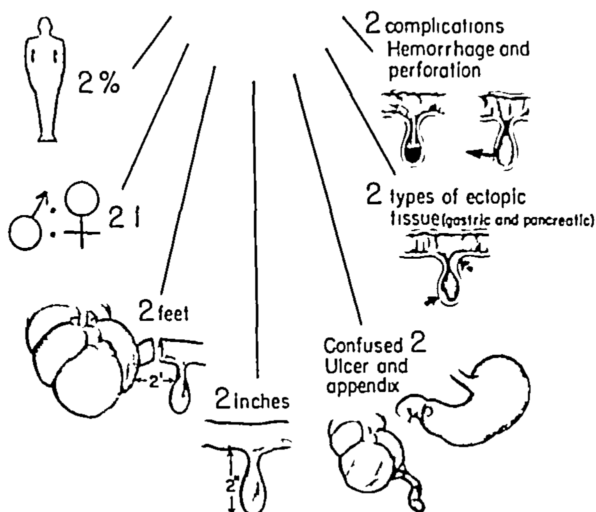


Fig 125 Meckel s diverticulum This is the disease of 2 s

Climate and geographic distribution seem to be factors the disease is uncommon in the region of the Gulf of Mexico and the Caribbean Sea The average age group affected is between 25 and 35 years although it has been encountered in practically every decade

The disease is characterized by scarring inflammatory changes and destruction which involves the wall of the small intestine its mesentery and regional lymph nodes As originally described it was thought that it involved only a few inches of terminal ileum hence the term terminal ileitis It became apparent however that the disease could affect any segment of bowel Multiple foci throughout the jejuno-ileum are occasionally present with apparently normal bowel intervening the latter sections have been called skip areas "

The clinical picture is varied the prominent features being diarrhea fever and loss of weight diffuse lower abdominal distress and progressive anemia frequently are present Because of the lack of conformity to any specific clinical pattern it is best to consider the condition in 4 stages (Fig 126)

Stage 1 is the inflammatory stage This is frequently mistaken for acute appendicitis and many times the true condition is not revealed until laparotomy has been performed The complaint is one of generalized

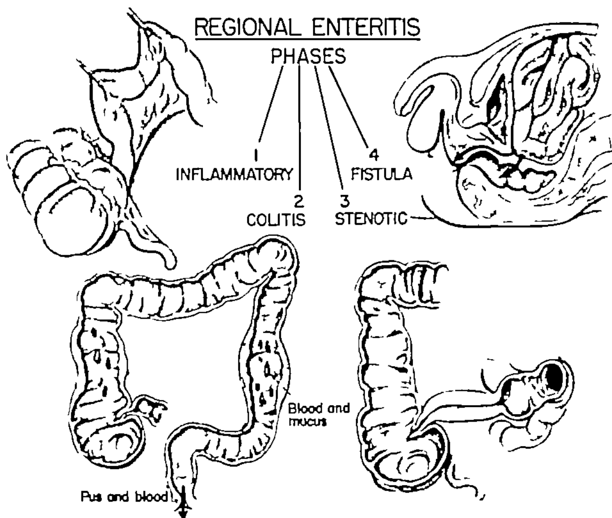


FIG 126 The 4 phases (stages) of regional enteritis. These stages gradually merge with each other and may overlap.

abdominal distress associated with pain and tenderness which may be localized in the right lower quadrant. Low-grade fever and leukocytosis are also present The clinician should suspect something unusual when the history reveals an insidious onset A mass is usually palpable in the right lower quadrant frequently this is detected rectally If the patient is operated upon during the inflammatory phase particularly if the terminal ileum is involved the condition should be diagnosed immediately because of the edematous and hyperemic appearance of the involved bowel. The adjacent mesentery is thickened and edematous and the regional lymph nodes are enlarged and friable. Occasionally, an abscess may be present in the mesentery When regional enteritis is discovered removal of the appendix is contraindicated. If appendectomy is performed in the presence of terminal ileitis, a so-called "fecal fistula" frequently results which can continue to drain until the true nature of the disease is discovered and if possible, eradicated

Stage 2 is the colitis stage This stage probably results from the spread of the disease across the ileocecal valve to the cecum and the colon These patients present a chronic history of a persistent diarrhea which contains mucus and blood. A low grade fever loss of weight and strength are

noted and the patient presents an anemic appearance In this stage the abdominal cramping distress is not severe

Stage 3 is the stenotic stage in which the signs and symptoms are those of small bowel *obstruction* Cramps nausea vomiting and at times visible peristalsis are present Constipation is the rule A mass in the right lower quadrant is almost always palpable in this stage

Stage 4 is the fistula stage This late stage is characterized by fistulas which may extend from one segment of bowel to another Fistulas also occur externally through the abdominal wall particularly in an abdominal scar The perineum is not an unusual location for such abnormal openings Anal fistulas may be directly connected to diseased bowel in the pelvis or may result from local inflammation and irritation produced by the diarrhea Such fistulas always should suggest regional enteritis to the clinician The fistula phase has been confused with tuberculosis and actinomycosis as well as other chronic specific granulomas

When suspected fluoroscopic and roentgenologic examinations usually will reveal the classical changes The terminal ileum is involved for a distance of several inches this is characterized by stiffness of the bowel wall narrowing of the lumen and alteration of the normal mucosal pattern Occasionally frank ulcers can be demonstrated The so-called string sign" is present in the late stages of the disease

The prognosis must be guarded A period of several years of apparent good health may be followed by exacerbations The disease is a discouraging one and extremely difficult to treat

Ulcers

Both nonspecific and stomal ulcers can involve the small bowel

Gastrojejunal ulcers have been referred to as stomal or marginal ulcers This is a distressing postoperative complication which usually follows gastrojejunostomy Less frequently it is encountered as a complication of gastric resection It is directly related to the persistent ability of the remaining stomach to produce excessive amounts of gastric acid The clinical manifestations are similar to those described under gastric and duodenal ulcers (p 110) but are more severe The pain is usually located to the left of the mid line of the abdomen and is associated with tenderness at this point Such ulcers have the same complications as peptic ulcers elsewhere namely hemorrhage obstruction and perforation Since the anastomosis is close to the transverse colon perforation of a stomal ulcer may occur into the transverse colon and result in a gastrojejunocolic fistula Definitive diagnosis is made roentgenologically The diagnosis is important since most gratifying results are obtained with vagotomy

Nonspecific ulcers of the jejuno-ileum constitute one of the rare and enigmatic diseases of the abdomen Little is known of their etiology and the clinical picture is vague and confusing The complications are the same as those of ulcers described elsewhere

Tumors

Both benign and malignant tumors of the jejuno-ileum occur in approximately the same frequency

Benign The benign tumors are usually lipomas leiomyomas, fibromas and polyps they are often the cause of an intussusception

The symptoms vary greatly When they become large they present the picture of small bowel obstruction With perfection in roentgenologic technics it is likely that these lesions will be identified more frequently before the development of obstruction

Malignant. The malignant tumors of the jejuno-ileum are either carcinoma or sarcoma Most *carcinomas* are found in the jejunum but appear at an earlier age than colonic carcinomas Symptoms if present

are associated with varying degrees of obstruction They may spearhead an intussusception Although the jejuno-ileum can be involved in generalized polyposis, it is rare for carcinoma to develop in the small intestines This is unlike the behavior of multiple polyposis in the large bowel

Sarcoma of the small intestine is a rare disease and occurs more frequently in males Unlike carcinoma, the lesions are often multiple The symptoms are those associated with obstruction, ulceration or intussusception

VASCULAR ACCIDENTS

Intestinal infarction due to vascular occlusion may be arterial or venous Involvements of the superior mesenteric vessels are particularly serious. Emboli in the superior mesenteric artery usually represent fragments of vegetations from cardiac valves on the left side of the heart Superior mesenteric vein thrombosis usually is associated with inflammation within the area drained by this vessel Thrombi may be propagated in a retrograde manner from the portal vein

Embolic occlusion of the superior mesenteric artery usually is seen in elderly people with advanced arteriosclerosis Males are affected more commonly than females The clinical picture is characterized by dramatic suddenness with severe abdominal pain and shock Frequently it is diagnosed as intestinal obstruction The obstruction phase" predominates because of the rapidity in development of abdominal distention obstipation and prostration An extensive generalized peritonitis is soon evident The bowel supplied by this vessel becomes gangrenous unless it is resected multiple perforations develop and the patient succumbs rapidly If the occlusion involves the main trunk of the superior mesenteric artery the entire jejuno-ileum and the right half of the colon are involved. If lesser branches are affected smaller areas of infarction result the latter respond well to *early resection and anastomosis.*

Thrombosis of the superior mesenteric vein is more common than the corresponding disease in the artery These venous thrombi usually are associated with an inflammatory process, particularly acute appendicitis, regional enteritis, ulcerative colitis and diverticulitis Also, bowel distention may produce thrombosis.

Thrombophlebitis can originate in the small veins about an acutely inflamed appendix even after the removal of the infected appendix. The process continues proximally and involves larger tributaries of the portal system Should this propagation continue the thrombosis reaches the portal vein (pylephlebitis) via the superior mesenteric vein. The amount of damage to the bowel wall varies with the rapidity with which the process spreads If there is slow propagation or if there has been a pre-existing portal obstruction sufficient collateral circulation may have developed to protect the bowel from gangrene Distention is marked and is mistaken for a postperitoneal bowel obstruction If the patient passes dark bloody fluid per rectum the clinician should consider superior mesenteric vein thrombosis or thrombophlebitis in the differential diagnosis

The inferior mesenteric artery is rarely the site of an embolus However if this should occur it is rarely fatal, because the anastomosis of this vessel with the superior mesenteric and hemorrhoidal vessels form adequate collaterals to the involved segment of bowel.

It has been the author s experience to suspect mesenteric thrombosis or embolus in any case of *small bowel* intestinal obstruction in which no scar from previous abdominal surgery is present, particularly if the patient is past 50

CYSTS

So-called gas cysts of the intestines occur in clusters and resemble 'soapsuds." On puncture they sometimes produce an audible popping sound.

Enteric cysts or duplication cysts have been found throughout the length of the bowel. They are developmental anomalies and are uncommon. They appear along the antimesenteric border of the bowel. If such a cyst increases in size it may retain its original submucosal position and replace the lumen of the bowel by inward displacement of the mucosa. These patients present a clinical picture of intestinal obstruction.

Lymphatic cysts are also of congenital origin; they are rare.

Acute Mesenteric Lymphadenitis

The etiology of this condition is obscure. It occurs chiefly in children and in those who have had a recent upper respiratory infection. It is difficult, and at times impossible to differentiate from acute appendicitis. The clinical picture presents abdominal pain, nausea, vomiting and tenderness in the right lower quadrant, particularly in the region of McBurney's point. The glands involved are particularly in the mesentery of the terminal ileum. If one can be certain of the diagnosis, the treatment should be conservative and not surgical. Chronic mesenteric lymphadenitis usually is associated with a specific granulomatous disease.

Congenital Defects

These defects result from abnormalities in the rotation of the bowel. If intestinal obstruction results, symptoms become evident and early intervention is necessary. The patient is usually a child in whom vomiting is the cardinal symptom. Since most of these conditions occur distal to the ampulla of Vater, bile is present in the vomitus. Intestinal obstruction in children should suggest such a congenital condition. (See Intestinal Obstruction, p. 161.)

APPENDIX

Appendicitis

Acute appendicitis was first described in 1886 by Reginald Fitz. The literature which contains thousands of reports is replete with every aspect of this disease.

Incidence. Typically the disease appears in the second and the third decades but may occur at any age. If present in children or the aged, the clinical picture is altered and is more difficult to interpret. After the age of 40 acute appendicitis becomes less frequent.

Etiology. Although the exact cause is unknown, *stasis* plays an important role in the etiology. Such stasis may be due to a fecalith, a kink, a congenital band, or edema. Bacteria, which are omnipresent, increase in number with stasis and inflammation results. Within the first 24 hours following obstruction the appendiceal wall becomes thick and edematous and the lumen may be filled with pus. Should the appendiceal outlet suddenly open and the contents be discharged into the bowel, the acute phase of the attack subsides spontaneously. If, however, the lumen remains obstructed, the disease progresses. After 24 hours in the typical case the serosa becomes covered with exudate and cloudy fluid appears in the peritoneal cavity.

Symptoms. The symptoms in the typical case follow a definite pattern. *Any diffuse epigastric distress that localizes to the right lower quadrant within 24 hours is acute appendicitis until proved otherwise.* However, this is not the terminology that a patient uses. He complains of a "bellyache," "gas pains" or a "spoiled stomach." Being certain that it is "something I ate," he unfortunately takes the advice of a well meaning friend or relative and attempts to relieve his 'bellyache' with a cathartic. This unfortunate act is largely responsible for the still high mortality in this condition. The cause of mortality in acute appendicitis is closely associated with the three "P's," namely *P*urgation, *P*rocrastination and *P*oor surgical judgment. In only 10 per cent of the cases is the pain colicky and in a much smaller percentage is the pain severe enough to require sedation. If the patient requires sedation for pain, the condition is rarely

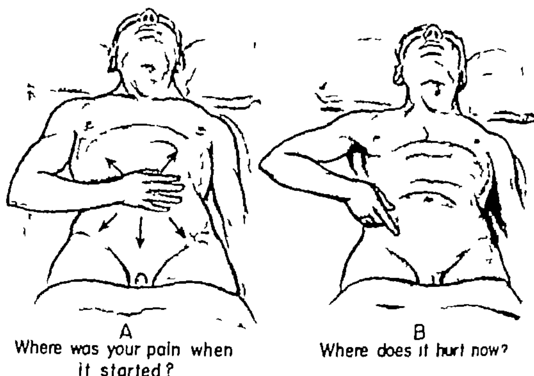


Fig 127 The 2-question test. (A) The patient demonstrates a pattern of diffuse abdominal distress in answer to the first question. (B) In answer to the second question he pinpoints his tenderness to McBurney's point.

appendicitis. Pain that begins in the lower abdomen and remains there is more suggestive of pelvic disease than appendicitis.

Diagnosis The *2-question test* permits one to diagnose acute appendicitis rapidly in over 80 per cent of cases (Fig 127) It is conducted in the following way *Question No 1* "Where was your pain when it

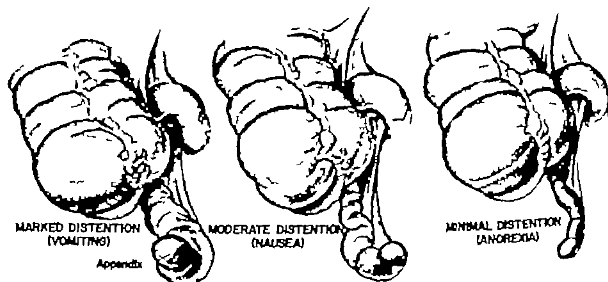


Fig 128 Anorexia nausea and vomiting are 3 degrees of one symptom they are dependent upon the amount of distention in the appendix.

started? In answer to this the patient points to his entire abdomen or periumbilical region (Question No 2 "Where is your pain now?" In answer to this the patient points to his right lower quadrant If the 2-question test is positive the condition must be considered one of appendicitis until proved to be otherwise

A frequent complaint is the sensation of a desire to defecate but the inability to do so The patient feels that if he could have a bowel movement he would feel much relieved

Nausea and vomiting are exceptions rather than the rule It is unfortunate that the importance of *anorexia* has not been stressed Anorexia nausea and vomiting should be considered as 3 degrees of one symptom (Fig 128) If a patient has a markedly distended appendix vomiting may be present If there is moderate distention nausea is usually present and since all patients with acute appendicitis have microscopic distention of the appendix then theoretically at least all patients with appendicitis have anorexia This is so typical and constant that when a patient states that he is hungry acute appendicitis is rarely the cause of his trouble

There is usually a change in the daily stool habit constipation is the rule Diarrhea is most unusual in acute appendicitis in adults however it is frequently present in children Chills (not a chilly sensation) are rarely found in appendicitis If a true chill is present this suggests an empyema of the appendix or an appendiceal abscess

Physical Findings An elevated *temperature* is rare in acute appendicitis Fever when present is due to peritoneal soiling The *pulse* is of little diagnostic value in that it is usually normal or maintains a given ratio with the temperature For every degree rise in temperature there is a 10-beat increase in pulse

Tenderness is present *at McBurney's point* (Fig 129) This is located by drawing an imaginary line between the right anterior superior iliac spine and the umbilicus this line is trisected McBurney s point is located 1 cm below the outer trisection point Although some (neuroanatomists) insist that this point remains constant regardless of the location of the appendix the author is convinced that the tenderness is located wherever the involved appendix is located An almost infallible diagnostic rule is the following pain, a symptom may be referred anywhere along its nervous path but tenderness a physical finding remains at the site of the lesion It is advantageous to permit the patient to identify the spot that is most tender

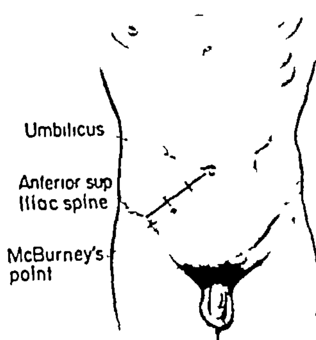


Fig 129 McBurney s point. The point of tenderness of an acute appendix is not constant since it is dependent upon the location of the inflamed organ

It is not the desire of the author to confuse when he states that acute appendicitis does *not* produce right rectus rigidity This sign has been mistaken for muscular defense If one exerts pressure over an inflamed appendiceal region both recti must contract simultaneously This is *muscular defense* (Fig 130) It is impossible for most people to contract one rectus muscle volun

tarily without contracting the other There fore to elicit true *right rectus rigidity*, both hands must be placed on the abdomen at the same time If upon so placing both hands the physician demonstrates that one rectus is relaxed whereas the other remains rigid, this is true unilateral rectus rigidity The demonstration of such a phenomenon

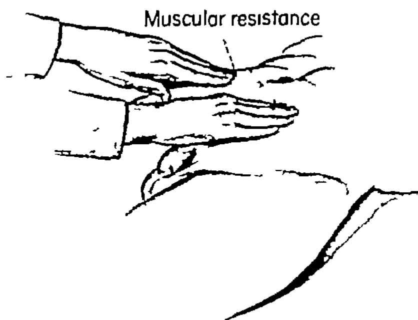


FIG. 130 Muscular defense This must not be confused with right rectus rigidity The former is demonstrated by placing *both* hands on the abdomen simultaneously and feeling the resistance of both recti

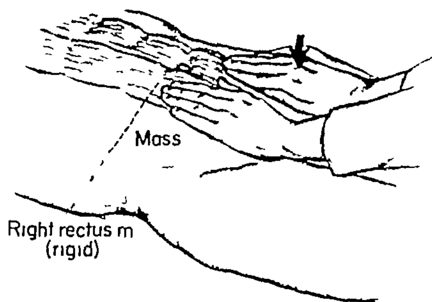


FIG. 131 Right rectus rigidity With both hands placed on the recti simultaneously the examiner detects that the left rectus is relaxed but the right rectus is tense. This is produced by an under lying mass (inflammatory or neoplastic.)

indicates the presence of a mass (Fig 131)

DIAGNOSTIC AIDS Too many signs have been described as aids in the diagnosis of acute appendicitis To enumerate these would be merely a display of "cerebral muscle" However a few important and practical signs will be discussed

Rovsing's sign is positive if the patient experiences pain in the right lower abdominal quadrant when pressure is made over the left lower quadrant Presumably this is the result of a displacement of colonic gas to an inflamed appendiceal or cecal region

The *psoas* and the *obturator signs* although usually described with acute appendicitis do not diagnose this condition but rather *locate* an inflamed appendix The *psoas sign* is elicited by placing the patient on his left side and hyperextending the right leg This stretches the psoas muscle and elicits pain if an associated fasciitis is present with a *posteriorly placed* inflamed appendix (Fig 132) The *obturator sign* is elicited by internal rotation of the flexed right thigh This stretches the obturator internus muscle and fascia (Fig 133) If this maneuver elicits pain it suggests an obturator internus fasciitis and an inflamed pelvic appendix

Peritoneal rebound implies the presence of a peritonitis regardless of the cause (Fig 134) The physician should explain to the patient what he is about to do, so that the sudden release of abdominal pressure does not frighten the patient and produce a false response

A *rectal examination* must be included if the patient is to be examined thoroughly At times a palpable mass or tender area will be felt on the right side (Fig 135) In children and in thin individuals with generalized visceroptosis inflamed appendices are palpated easily The *bimanual examination* should be included to rule out pelvic disease however, more important than the latter is the *bidigital examination* This is conducted by placing one finger in the vagina and another finger in the anal orifice with the perineum between (Fig 136) This differentiates feces from cervix, adnexal and uterine enlargement, or intraperitoneal pelvic masses

LABORATORY TESTS These procedures should be considered last and least impor

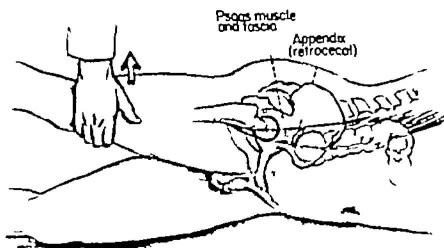


FIG 132 The psoas sign This does not diagnose but rather locates an inflamed retrocecal appendix

tant they supply corroborative evidence The *leukocyte count* usually is elevated, being over 12 000 in more than half of the cases however it is well known that acute gangrenous appendicitis can occur with normal white blood cell count The differential blood count may be more helpful than the total white count *Urinalysis* is done

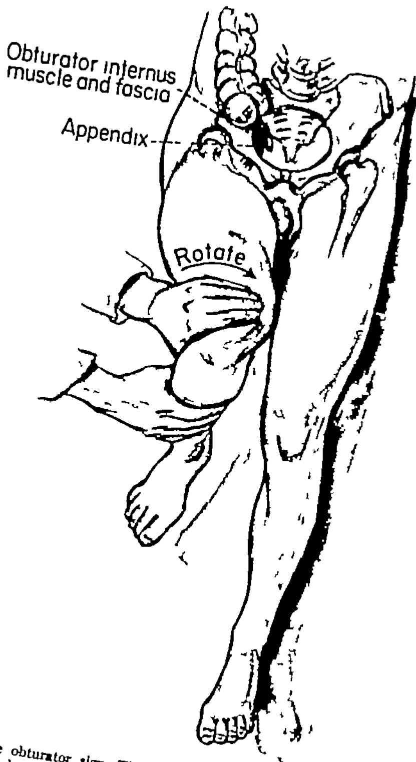


FIG 133 The obturator sign This does not diagnose but rather locates an inflamed pelvic appendix.

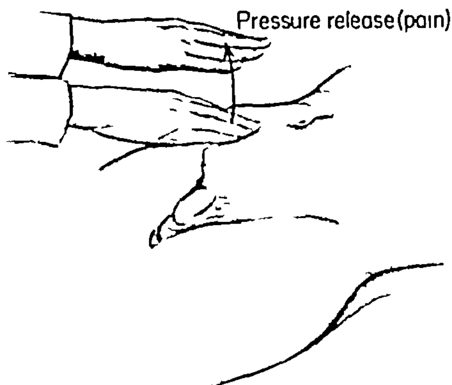


Fig 134 Peritoneal rebound When present this sign suggests peritonitis regardless of the cause It may be executed in any abdominal quadrant and is demonstrated best by making firm steady, yet gentle pressure with one hand and then suddenly releasing The complaint of pain with release of pressure suggests peritonitis

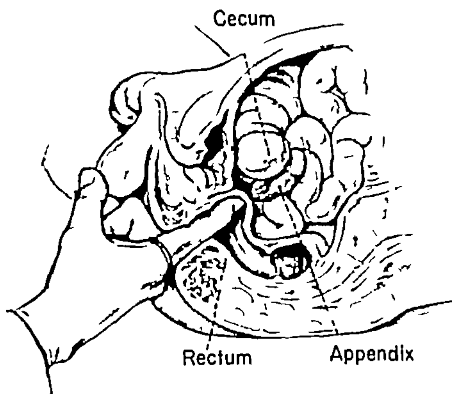


Fig 135 The importance of the rectal examination cannot be over stressed It may be the only positive finding in acute appendicitis, particularly in children and in pelvic appendicitis.

routinely However, an acute appendix located close to the bladder, the right ureter, or the lower pole of the right kidney may produce an inflammatory response around the bladder, the ureter or the kidney that results in a hematuria The *flat roentgenogram* should be used only when the diagnosis is doubtful. Rarely is a spontaneous pneumoperitoneum produced by a perforated appendix (p 119) If this is found, then one must assume that the appendix was *of tremendous size and greatly distended*

The late (neglected) cases of acute appendicitis manifest the following complications local or generalized peritonitis, subdiaphragmatic abscess, intestinal obstruction jaundice and pylephlebitis (These conditions are discussed under their specific headings.)

DIFFERENTIAL DIAGNOSIS The differential diagnosis of acute appendicitis is in reality the differential diagnosis of the "acute abdomen" To list and discuss 80 or 100 conditions which by the stretch of the imagination might simulate an acute appendicitis is most impractical Seven conditions constitute 90 per cent of the diagnostic errors. These are acute cholecystitis, renal and/or ureteral colic, perforated peptic ulcer, acute hemorrhagic pancreatitis pelvic inflammatory disease pneumonia and coronary disease These conditions are discussed under their own headings

An *appendiceal abscess* should be suspected if the case is over 2 or 3 days in duration and presents a septic syndrome. By septic syndrome is meant an "iceberg" fever, chills profuse sweats and a leukocytosis over 18,000 to 20 000

Subacute appendicitis is the designation applied to an appendix which was acutely inflamed some weeks or months prior and is now quiescent or subsiding

Chronic appendicitis is still a debatable condition. It must be admitted, however that the appendix, as any other organ, can

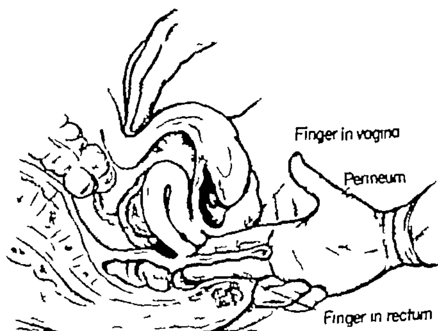


FIG 136 The bidigital examination. With one finger in the vagina and one finger in the rectum, one can differentiate feces, adnexal and uterine masses from other intraperitoneal pelvic enlargements.

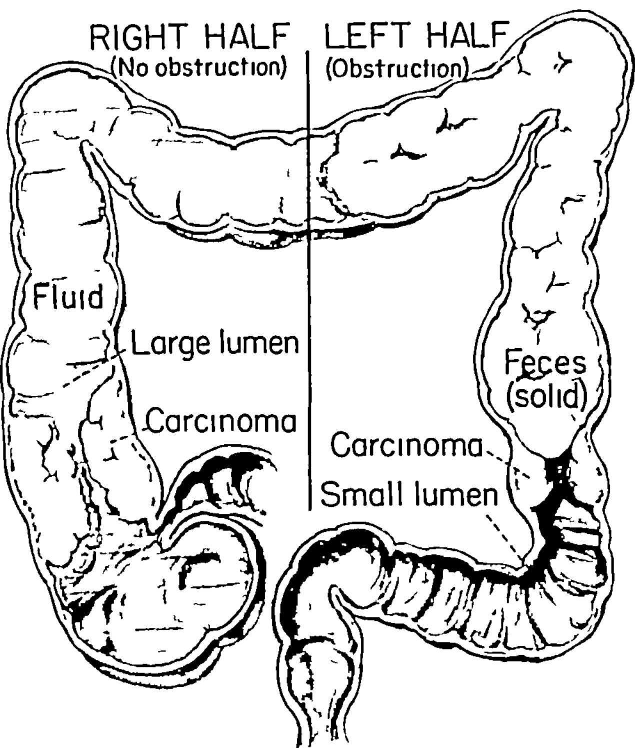


FIG 137 Carcinoma of the *right* side of the colon does not produce obstruction because the intestinal contents are liquid and the lumen is large Carcinoma of the *left* side of the colon frequently is associated with obstruction because the intestinal contents are solid and the lumen is small

be chronically inflamed as the result of previous acute attacks In the absence of chronic inflammatory changes which should be demonstrable microscopically what is meant by chronic appendicitis? The appendix may become obstructed as in the case of any other organ that has a lumen Such obstruction results in *appendiceal colic* but inflammatory changes may be lacking, particularly if the obstruction is overcome spon

taneously Although such appendices might not reveal inflammatory signs, early relief is obtained after appendectomy

Miscellaneous Conditions

Tumors rarely affect the appendix Carcinoid tumors involve it and consist of glandular and embryonal elements They are encountered accidentally under the erroneous diagnosis of an acute or "interval" appendicitis *True carcinoma* of the appendix is rare, these too, are usually found accidentally The so-call d *mucocele* of the appendix is present not infrequently it results from an overabundance of obstructed mucuslike material that has become entrapped in the appendiceal lumen Usually it is diagnosed as "chronic appendicitis" The appendix may be involved in tuberculosis, actinomycosis and other granulomatous conditions

COLON

Carcinoma of Right Half of Colon

The clinical picture of carcinoma of the right half of the colon and the cecum is entirely different than that of the left half There are 2 reasons for this (1) the lumen of the large bowel diminishes from cecum to sigmoid (2) the contents of the right half of the colon are liquid and those of the left half are solid (Fig 137) Since the right side of the colon has a large lumen and liquid contents the obstructive phase is almost completely lacking

It usually occurs in the fourth the fifth or the sixth decade The earliest symptom is frequently a mild intermittent nondescript discomfort in the right lower quadrant Unfortunately this rarely is severe enough to warrant an examination Less specific complaints are nausea anorexia epigastric distress and possibly low-grade fever Bowel habits may be altered (constipation and diarrhea) although this change never is as marked as that observed with tumors on the left side of the colon Loss of strength and weight are late signs Unfortunately the condition progresses insidiously until the patient becomes aware of increasing weakness, pallor or a palpable mass. Right sided carcinomas particularly those affecting the cecum ulcerate and assume a polypoid form They bleed readily Some of these anemias are so severe that the patient resembles a case of pernicious anemia. Although blood may not be visible on gross examination of the stool it is invariably detectable with chemical analysis.

An office technic which is simple for the detection of occult blood in the feces in unprepared patients is worth while (Fig. 138) The benzidine and the orthotolidine tests are too sensitive for routine use in patients who have not been prepared with a meat free diet The guaiac test appears to be the best for this purpose. It can be carried out in the following way the 3 reagents necessary are guaiac solution glacial acetic acid and hydrogen peroxide These can be kept easily in small standard drop bottles. A saturated solution of guaiac crystals in 95 per cent alcohol is satisfactory One or two drops of each solution is placed in sequence and the test is read within 30 seconds Other color changes or delayed color changes are to be regarded as negative. No test is foolproof however positive reactions with this simple procedure warrants a thorough study of the case.

Physical examination reveals a palpable mass in approximately 25 per cent of these patients the mass is firm and somewhat nodular Some vague local tenderness is usually present in the region of the tumor

It is fortunate that carcinoma of the right colon particularly the cecum has a marked tendency toward localization Spread occurs late in the course of the disease either to regional lymph nodes via the portal vein to the liver or direct extension by contiguity to surrounding structures.

Fluoroscopic and roentgenographic examinations with retrograde instillation of barium into the colon and by contrast air studies usually confirm the diagnosis.

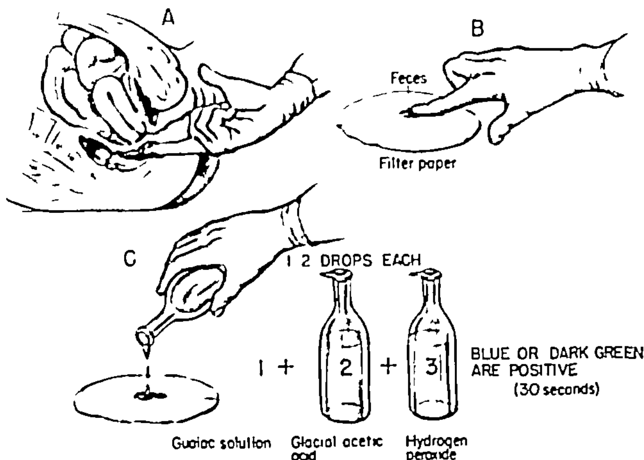


FIG 138 The guaiac test for occult blood in the feces (see text)

Five year survivals (note the word cure has not been used) as high as 75 per cent have been reported following radical surgical therapy

It is important to emphasize the relationship of the appendix to right sided carcinoma Since the earliest symptoms of carcinoma of the cecum are associated with the right lower quadrant the physician might suspect appendicitis If the patient is subjected to appendectomy the appendix usually is found to be normal although various types of appendiceal changes have been reported which occur secondary to the cecal lesion Particularly confusing is the presence of a gangrenous appendicitis which can result from carcinoma obstructing the appendiceal lumen Then an appendectomy may be performed and the carcinoma overlooked Localized peritonitis and periappendiceal abscesses have been drained and the primary carcinoma has been overlooked

Although bowel obstruction is most unusual in right sided carcinoma it may occur in the late case when the tumor has assumed tremendous size or if the ileocecal valve has been invaded

CARCINOMA OF LEFT HALF OF COLON

Carcinoma of the left side of the colon is considered separately because the outstanding findings are those of obstruction This is in contradistinction to the nonobstructive carcinoma of the right side of the colon The reasons for the obstructive manifestations in the left colonic segment are due to the smaller size of the lumen and the solidity of the contents (Fig 137)

Little is known of the etiology however some benign lesions are known to be complicated by carcinoma Benign polyps may undergo malignant degeneration The incidence of malignancy in multiple polyposis of the colon is so high that radical resection

must receive serious consideration Chronic nonspecific ulcerative colitis is also associated with carcinomatous degeneration

Approximately half of all colon carcinomas occur in the sigmoid region In frequency this is followed by the ascending colon, the splenic flexure the transverse colon, hepatic flexure and the descending colon (Fig 139)

Carcinomas of the left colonic segment *are usually of the infiltrative type and produce* a so-called 'napkin ring' type of deformity The most common and possibly the earliest complaint is a *'change in stool habit"* Most people have a stool habit, whether the bowel movement is once a day or once a week Whenever this pattern changes, carcinoma of the colon must be ruled out. Constipation is the rule, but this may alternate with diarrhea. Narrowing of the lumen produces "ribbonlike" stools, however, this is a late and overemphasized sign of carcinoma. Cramping or colicky distress is usually present The onset is insidious and mild, and unfortunately much valuable time is lost in discovering the tumor Often on the surface of the stools are streaks *or flecks of bright-red blood.* It is unfortunate that the patient may associate such bleeding with 'piles , also, the physician may confirm the presence of piles. A good rule to follow is that the presence of blood in the stool, particularly if hemorrhoids are present, should be considered carcinoma

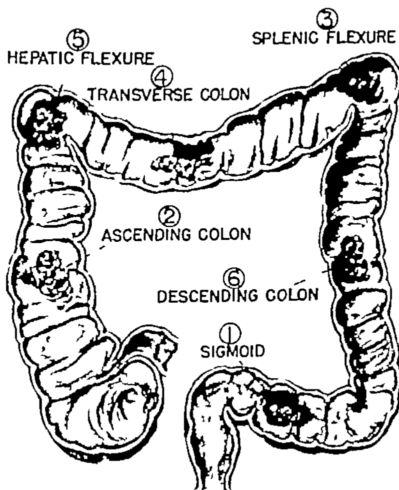


FIG 139 Frequency of locations in carcinoma of the colon. The rectosigmoid junction is by far the most common site.

until proved to be otherwise. Frequently carcinomas at the so-called rectosigmoid junction can be palpated rectally. At times the tumor is palpable abdominally.

The colon proximal to the obstruction becomes dilated, edematous and friable. The patient presents the picture of a nonstrangulated large bowel intestinal obstruction (p. 161). If the obstruction is unrelieved, stercoral ulceration develops which leads to bowel perforation and peritonitis. The tumor itself may perforate the colonic wall. Surrounding structures are involved by contiguity, particularly the abdominal wall and the small intestine. If ulceration and secondary infection supervene, a septic course appears with fever, chills, sweats and an elevated leukocyte count. Although carcinoma of the left half of the colon produces obstruction, these patients may have secondary anemia also. The tumor may spread via the regional lymph nodes or the blood stream.

The diagnosis can be established with a fair degree of accuracy by means of the roentgenologic examination after the retrograde instillation of barium. It is unwise whenever suspecting a colon or an obstructing lesion to give the patient barium by mouth since this may obturate the lumen. Double contrast air technics are particularly valuable in evaluating lesions of the hepatic and the splenic flexures. Proctoscopic examinations are helpful in diagnosing carcinoma of the rectosigmoid junction and the lower sigmoid colon (p. 157).

The discovery of one carcinoma does not rule out the existence of another. Five per cent of all colon carcinomas are multiple.

Resection is possible in over 80 per cent of patients with colon carcinoma, and approximately 50 per cent of such patients are alive 5 years later; this picture is a happier one than carcinoma of the stomach. Since this is one of the more favorable visceral cancers, early diagnosis is imperative, thorough study is vital and energetic therapy is mandatory.

Prognosis in carcinoma anywhere must be extremely guarded. To discuss "5-year cures" seems to be erroneous when one realizes that 20-year survivals with metastases are recorded.

Benign Tumors of the Colon

The 3 most common benign growths are the adenomatous polyp, the papilloma and the lipoma. Uncommon benign tumors are fibromas, hemangiomas, leiomyomas, neurofibromas and melanomas.

The adenomatous polyp may be seen at any age and in any portion of the colon. It is situated most commonly in the sigmoid and the rectum. Every adenoma must be considered as a malignant growth until proved to be otherwise. In children they have a tendency to occur singly and produce prolonged intermittent bleeding. In adults they are usually multiple. They may be the basis for acute or chronic obstructions and they form an ideal spearhead for an intussusception (p. 168). Endoscopic as well as roentgenologic examinations are helpful in the diagnosis and the progress of these tumors, particularly when they are pedunculated and removed locally.

Lipomas can occur anywhere in the gastro-intestinal tract but are found most commonly on the right side of the colon (cecum, ascending and transverse colons). There is no clinical syndrome that is pathognomonic of such tumors. Symptoms referable to intestinal obstruction or intussusception may be present. Obstructions may be acute, subacute or chronic. When chronic, the symptoms are present for months or years and consist of vague abdominal distress; there are frequent remissions and exacerbations. Ulceration of the mucosa produces occult or visible hemorrhage. A positive diagnosis is rarely made preoperatively. It is usually thought to be a malignant neoplasm.

Papilloma of the colon is found almost exclusively in adults. It is located most frequently in the rectum. Since it bleeds readily

its presence becomes manifest with rectal bleeding These lesions can produce a hemorrhage that is alarmingly profuse Large papillomas are often malignant

Carcinoid Tumors

The exact nature of these tumors is still unknown They have been referred to as argentaffin tumors because they often contain silver reducing granules Although frequently encountered in the appendix and *the lower ileum they have been observed* in the colon also as well as in other parts of the gastro-intestinal tract.

The average age of patients with carcinoids of the intestines is in the fourth and the fifth decades however, appendiceal carcinoids are encountered usually in the second decade. The most common symptom in carcinoids of the intestines are those of intestinal obstruction

These tumors should not be considered as benign It is the consensus that from the very start they are malignant but that they grow slowly and metastasize late. Microscopically the tumor can be suspected when the cut surface appears *yellowish* and homogenous

Diverticulosis and Diverticulitis

Diverticula or tiny pouches of the colon are found frequently in people past 40 They appear most frequently in the sigmoid. Men are afflicted twice as commonly as

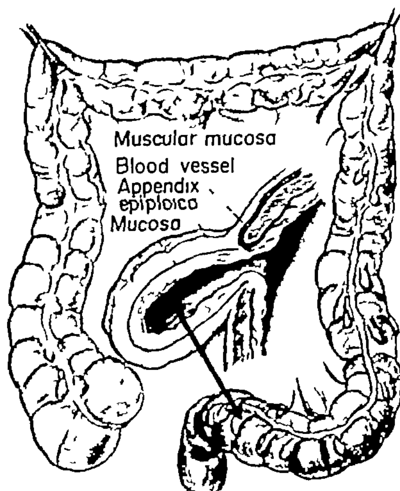


Fig 140 Diverticula of the colon are difficult to find during surgery because they are located in and hidden by the appendices epiploicae.

women and obesity is a contributing factor Colonic diverticula differ from those in the small intestine in that the former arise from various parts of the circumference of the bowel not being confined to the line of mesenteric attachment as are those of the small bowel Their origin is unknown however they occur through weak areas in the muscle coat at the site of the entrance of blood vessels The longitudinal muscle bundles afford some protection hence these diverticula tend to occur in 3 longitudinal rows which coincide with the intervals between the taenia coli The diverticulum is a herniation of mucosa and thinned muscularis mucosae which in no way differs from the bowel structure They are difficult to see when the exterior of the bowel is examined because they arise in the region of the appendices epiploicae and are hidden by these fatty caps (Fig 140)

By the term *diverticulosis* is meant the presence of diverticula By the term *diverticulitis* is meant inflammation of the diverticulum The incidence of diverticulitis in cases of diverticulosis is not known definitely However, physiopathology is more important than the statistical relationship So long as the neck of the diverticulum is wide and permits entrance and exit of colonic contents inflammation rarely occurs If the neck becomes constricted it produces obstruction stasis and inflammation (Fig 122)

Most individuals who have diverticula are unaware of their presence It is the complications of these pouches that produce symptoms these vary greatly in their severity from mild indigestion to severe abdominal distress The complications of diverticulitis are associated with obstruction inflammation and ulceration

A markedly inflamed diverticulum causes pain and tenderness these subside spontaneously if the diverticulum evacuates itself If the inflammatory process persists tenderness is demonstrable in the left lower quadrant (sigmoid) this has been called left sided appendicitis A pericolic abscess may result It is sharply localized and can become quite large Perforation results in peritonitis The most common cause of vesicosigmoidal fistula is diverticulitis of the sigmoid colon Should this occur the patient is aware of gas being passed when he urinates Scar tissue may deform the involved segment of colon and produce obstructive manifestations This may be difficult to differentiate from carcinoma however the involved segment is usually longer than that found with a malignant neoplasm *Hemorrhage* is worthy of special mention in cases of diverticulitis Although the bleeding is usually mild or occult it may be massive and critical

The presence of diverticula are ascertained best by roentgenographic examination The residual barium in these diverticula usually is expelled within 24 hours If this fails to take place stasis is suspected Diverticula may escape detection even with a careful roentgenographic technic, when they are filled with feces or inspissated mucus and prevent the entrance of the barium

Chronic Nonspecific Ulcerative Colitis

This name applies to a group of chronic ulcerating inflammations of the colon for which no definite etiology has been established

Etiology Various bacteria have been condemned the allergic theory has its proponents and there are those who consider nutritional deficiencies as the cause rather than the effect of the disease The neurogenic theory is currently popular since these patients often display emotional instability The frequent location of the ulcers along the course of the taeniae coli suggests that spasm along longitudinal muscle bundles may be a factor in the development of these ulcers There is evidence which indicates that deleterious changes may occur in the colon by way of impulses reaching it via the vagus or the pelvic nerves (Fig 141) The

author has advocated vagotomy in the treat ment of this disease Although this therapy is to be attempted with much trepidation and thought, it nevertheless warrants investigation. The condition usually begins in early adult life and affects both sexes with equal frequency Its course in interrupted by remissions unfortunately, exacerbations recur, and the disease continues in a progressive downhill course

The **symptoms** consist of "colicky" abdominal pain and diarrhea. The stools are semisolid or liquid and contain excessive amounts of mucus, pus and blood Rectal pain results from the frequent passage of copious liquid stools As the disease progresses, impaired digestive functions produce malnutrition and dehydration

Physical examination reveals intermit tent fever, anemia and tenderness, particu larly in the region of the sigmoid and the upper rectum Localized abscesses are prone to form, and these may perforate externally or into adjacent organs Fistulous communi cations between the colon and the small intestine the vagina, the uterus and the urinary bladder are not infrequent The ex ternal fistulas are encountered most frequently in the perianal region.

Fluoroscopic, roentgenologic and endoscopic examinations are most helpful. Proctoscopic examination reveals a mucosa that is hyperemic, ulcerated and bleeds readily Roentgenographic findings with barium instillation reveal a colon that is less distendable than normal and a narrowed lumen These findings may be local or gen eral The haustral markings are usually absent or less prominent, motility is dimin ished and the length of the organ is reduced. The margin of the colon has an irregular or "moth eaten" appearance due to the presence of edema and ulcers Later in the course of the disease the cicatricial narrow ing of the lumen makes differentiation from *carcinoma extremely difficult Particularly* is this so since malignant degeneration is in itself a complication of ulcerative colitis. The process may extend across the ileocecal barrier and into the terminal ileum (p 124) Pseudopolyps, a result of edema, may become so numerous as to fill the lumen of the bowel If marked, this produces a cobble stone appearance.

The **complications** are legion Study of Figure 142 will reveal many of the numer ous complications associated with this condition

The **differential diagnosis** must include bacillary and amebic dysentery, intestinal tuberculosis, benign and malignant tumors, congenital polyposis and venereal lymphogranuloma. True polypi microscopically reveal the characteristic adenomatous changes, whereas pseudopolyps are inflammatory Venereal lymphogranuloma is associated with a positive Frei test and an elevated serum globulin Bacteriologic study of exudate from infected inguinal glands and biopsy of the involved rectal mucosa are also contributory

The **prognosis** of ulcerative colitis always must be guarded

Polyposis of the Colon

Polyps can be found in any portion of the bowel however, there is a predilection for the rectum. They are encountered frequently in the alimentary tracts of children. There appears to be a familial tendency particularly when the polypi are numerous.

The most common complaints are bleeding and/or diarrhea.

Thorough endoscopic and roentgenologic examinations aid in their detection, location and number Removal of either a solitary polyp or a large segment of colon in the case of multiple polyposis is mandatory because of the tendency to malignant changes.

Megacolon

This section will consider the more common form of megacolon which is *congenital*, often it is referred to as Hirschsprung's disease *Acquired* megacolon is infrequent.

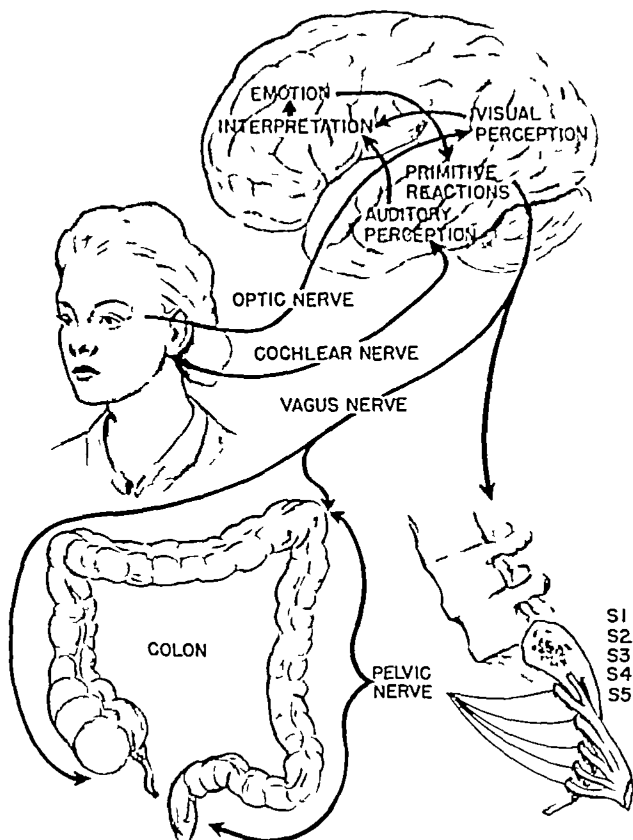


Fig 141 Nonspecific ulcerative colitis The emotional phase of this condition plays an important part. Since both halves of the colon are involved there apparently is some communication between the vagal component (worry nerve) and the sacral nerves.

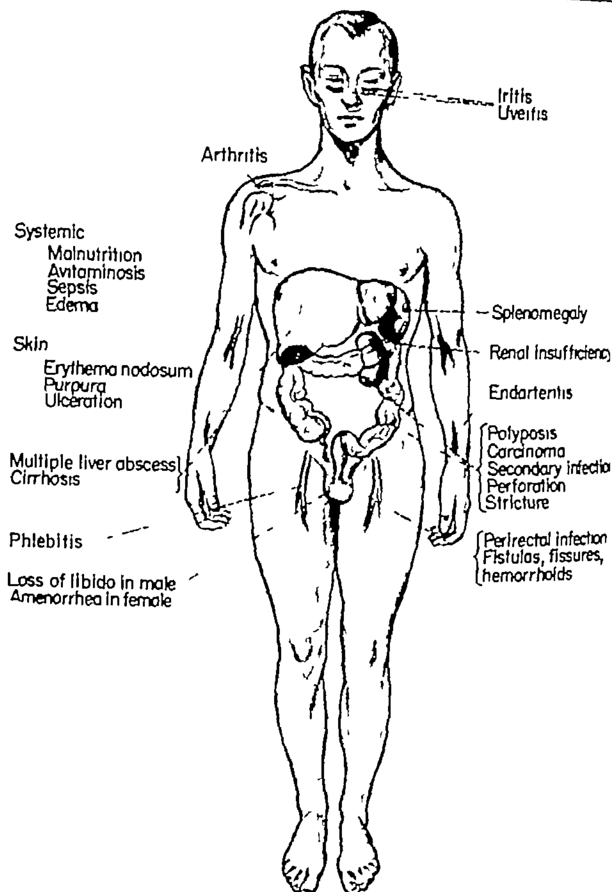


FIG 142 Complications of chronic nonspecific ulcerative colitis.

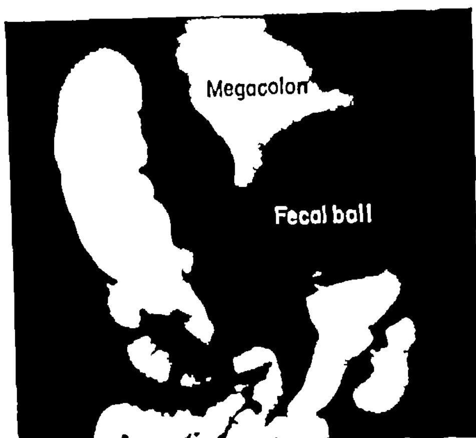


FIG 143 Roentgenogram of congenital megacolon (Hirschsprung's disease)

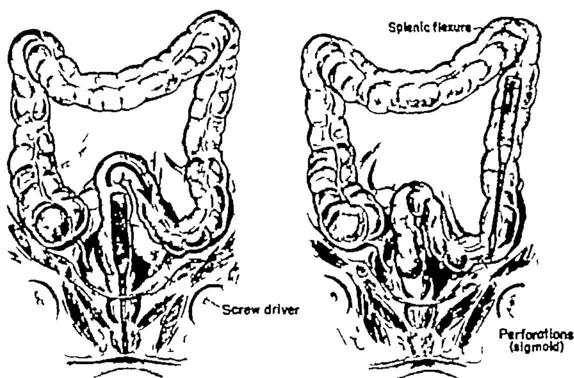


FIG. 144 Self introduced screwdriver which caused perforations of the colon.

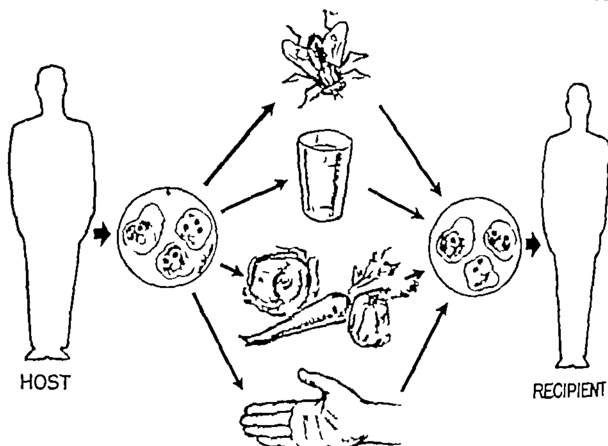


Fig 145 Amebiasis The encysted forms are the resistant ones. They are transmitted to the new recipient by the house fly through drinking water fresh vegetables or direct contact. Several aspects of amebic dysentery are of surgical importance.

Congenital dilatation of the colon is not uncommon, it occurs more frequently in males Constipation and abdominal distention occur early in the course of the disease This progresses to a state of extreme nutritional deficiency Fluoroscopic and roentgenographic studies reveal colonic dilatations that may assume tremendous proportions (Fig 143) The entire colon or any segments of the colon may be dilated Persistent fecal impaction with obstruction and perforation occur in the neglected cases Volvulus and strangulation of the bowel have been reported

Other organs may also be involved Mega esophagus mega ureter and megaduodenum have been known to occur concomitantly

Foreign Bodies

Foreign bodies may become lodged in the colon after their ingestion or after their placement per rectum Symptoms of obstruction may develop If the object is sharp, perforation can occur this may lead to peritonitis and/or abscess formation. Frequently such abscesses are misdiagnosed the preoperative diagnosis is usually appendiceal abscess or an abscess due to diverticulitis. The true nature of the condition may be discovered only at the time of exploration when the foreign body is found Fortunately many of these objects are radiopaque. Figure 144 illustrates a screw driver that was inserted into the rectum by the patient for the supposed purpose of reducing his prolapsed piles. It had traveled in a retrograde direction to the splenic flexure and was removed by incising the descending colon.

Specific Granulomas

Tuberculosis and actinomycosis must be mentioned the latter seems to be appearing

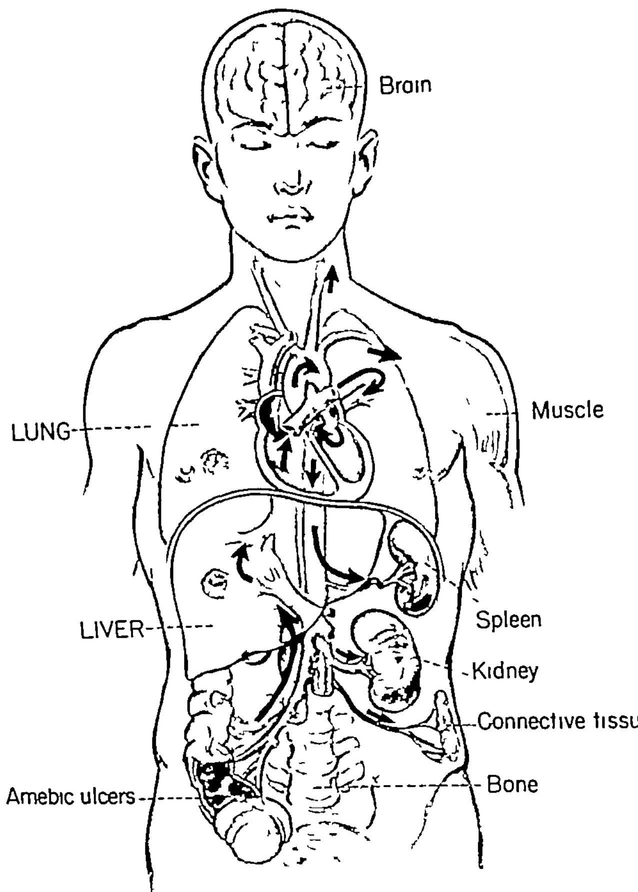


Fig 146 Amebic ulcer and some of the possible paths of extension and development of amebic abscesses

with increased frequency These will produce symptoms similar to any ulcerating bowel condition Actinomycosis usually is associated with the ultimate development of a mass and multiple fistulous openings Tuberculous ulceration of the cecum comprises one half of all intestinal tuberculosis Most of these patients have an active pulmonary lesion. In any draining sinus the specific granulomas must be considered

Amebiasis

Several aspects of amebic dysentery are of surgical importance The disease appears in endemic forms, but epidemic outbreaks do occur These usually are due to a contaminated water supply or fly transmission The trophozoites are of no great importance in the epidemiology of the disease, since they rarely survive exposure to hydrochloric acid digestive enzymes or life outside of the body However, the encysted forms are resistant and responsible for transmission which takes place in 1 of 4 ways the house fly polluted water vegetables, and direct contact with human carriers (Fig. 145) This condition should be kept in mind in any resistant case of gastro-intestinal disease regardless of geographic distribution

Ingested cysts of *Endamoeba histolytica* upon reaching the intestinal tract of the new host, excyst The resulting trophozoites penetrate the host s tissues. Lesions are found most commonly in the cecum the ascending colon the sigmoid and the rectum Since this stage is associated with abdominal pains and cramps and possibly tenderness in the right lower quadrant because of cecal involvement these cases may be mistaken for acute appendicitis Invasion of the submucosa may be followed by entry of the amoeba into radicals of the portal vein and metastases to the liver Amebic hepatitis or abscess of the liver is by far the most frequent and important complication Such abscesses may be single or multiple acute or chronic. Right lobe liver abscesses can extend upward penetrate the diaphragm and rupture into the lung. They also have reached the brain, skin, bladder, uterus and vagina (Fig 146) These may be associated with amebic sinuses.

UMBILICUS

The vitelline duct, the urachus and the umbilical vessels traverse the umbilicus. Only the first two are clinically important.

Vitelline Duct

The vitelline (omphalomesenteric) duct is a short lived structure but is important in the normal development of the embryo It acts as the communication between the embryo and the yolk sac and is obliterated by the seventh week of fetal life All or any part of this duct may persist (Fig 147) When the proximal portion persists the resulting outpouching which arises from the ileum is known as a *Meckel's diverticulum* (p 124) When the distal portion persists, a *superficial umbilical adenoma or polyp* forms this may be related to an incomplete sinus If the central portion persists, a *vitelline cyst* forms beneath the umbilicus or in the leaves of the mesentery of the ileum. When the entire duct persists a patent tube results which forms a *fistula* between the bowel and the umbilicus (Fig 148) If the lumen is small a watery mucoid discharge appears at the umbilicus but if the lumen is large a fecal fistula results

The direct and the differential diagnosis of persisting draining umbilical lesions is important In uncomplicated cases radio-paque material may be injected into the tract to determine its origin. Probing is dangerous since it does not give adequate information and may easily perforate the intestinal wall

Omphalitis

Omphalitis is due to uncleanliness. It produces a red weeping lesion at the umbilicus which must be differentiated from persistent granulating tissue, concretions, endometriosis, and primary or secondary tumors.

Congenital Umbilical Hernia (Omphalocele)

Congenital umbilical hernia differs from a prolapsed patent duct in that there is a transparent covering over the nonprolapsed herniated bowel A patent urachus is identified readily by the fact that urine leaks from the umbilicus, a cystogram corroborates the diagnosis Occasionally a loop of intestine herniates into the umbilical cord and is included inadvertently as the cord is tied This produces an *umbilical fecal fistula* Abdominal exploration is the only way that this condition can be identified with certainty and corrected

Urachus

The urachus is represented in adult life as an obliterated cord connecting the umbili

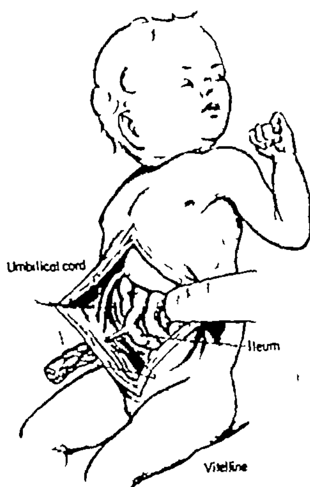


Fig. 147 The vitelline duct normally becomes obliterated by the seventh week of fetal life but all or any part of it may persist.

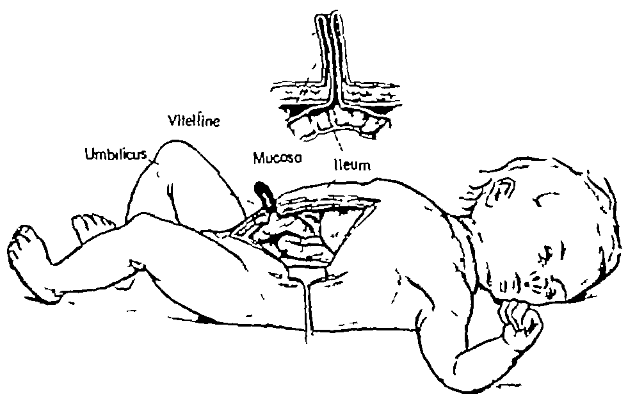


Fig 148 Persistence of the entire vitelline duct

cus with the dome of the bladder If it persists it gives rise to a draining sinus If it becomes obliterated only at its ends, a cyst forms If infected, a urachal cyst produces manifestations of a localized intra abdominal abscess that may simulate an appendiceal mass except for its location, which is in the mid line between the umbilicus and the bladder

NEOPLASMS

Umbilical neoplasms, particularly primary squamous cell carcinoma as well as metastatic carcinoma have been reported Any firm node in the region of the umbilicus should be removed for microscopic study, since these may be metastatic carcinomas from the gastro-intestinal tract or ovary

RECTUM AND ANUS

The incidence of anorectal diseases is high Every patient complaining of rectal symptoms, particularly bleeding constipation, pain and tenesmus must be examined carefully The importance of rectal examinations has been stressed repeatedly This is accomplished best with the patient on his left side or in the knee-chest position. Direct inspection with appropriate armamentarium and light is an indispensable part of the examination both the anoscope and the

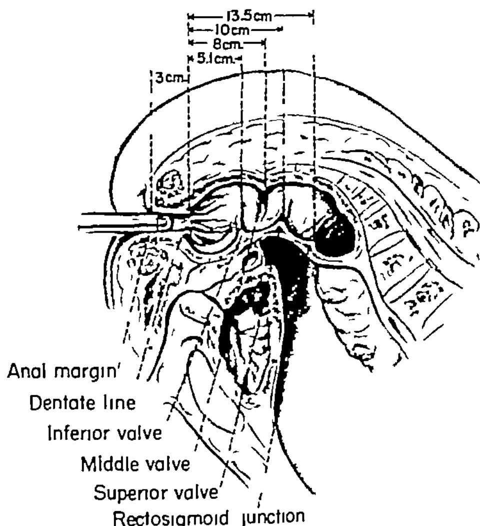


FIG 149 The anatomy of the anorectal region. The important anatomic landmarks and their locations are shown.

proctoscope are necessary If blood, pus and/or mucus are seen in the ampulla of the rectum with no visible lesion to account for the findings a careful roentgenologic study is required The examining physician should acquaint himself with the anatomy of this region so that he may be able to interpret the lesion and the location properly (Fig 149)

Hemorrhoids (Piles)

These are varicosities of the hemorrhoidal veins A simple classification into internal and external varities is adequate An *internal hemorrhoid* is covered with mucous membrane and therefore is proximal to the dentate line An *external hemorrhoid* is covered with skin and is distal to the dentate line. Internal hemorrhoids usually appear as 3 primary piles. These are the accompanying veins of the terminal branches of the superior hemorrhoidal artery

The etiology is obscure however they often occur after childbirth or represent chronic venous hypertension which is associated with such extrinsic factors as prostatic hypertrophy uterine enlargement or pelvic tumors Always to be considered is the possibility of venous obstruction due to rectal carcinoma Undoubtedly, there is a congenital deficiency which predisposes to the formation of hemorrhoids Hemorrhoids may be natures portacaval shunts and attempt to bring about a collateral circulation (cirrhosis of the liver) Whenever an individual is examined who has piles and no hair on his chest (cirrhotic habitus) one should be suspicious of cirrhosis of the liver Such hemorrhoids if possible, should not be disturbed (Fig 150)

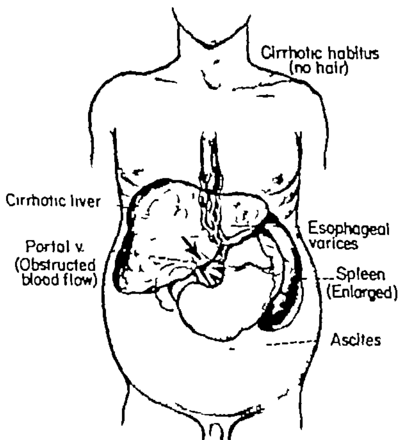


Fig 150 The cirrhotic habitus. Note the absence of hair of the chest.

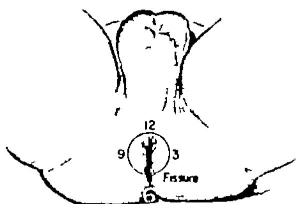


FIG. 151 An anal fissure is located in the 6 o clock position

Hemorrhoids *do not* cause pain Internal hemorrhoids protrude bleed or produce itch ing If pain is present it is due to infection, ulceration thrombosis or prolapse with strangulation External hemorrhoids rarely produce symptoms unless they become acutely inflamed or thrombosed A throm botic pile produces sudden localized pain, usually after defecating This may be severe enough to be completely disabling and may require sedation The diagnosis is obvious on inspection Internal hemorrhoids may not be felt on digital examination since the finger compresses the vein Demonstrable evi dence should be sought with the anoscope

Since internal hemorrhoids are above the dentate line they are not related to sensory nerve fibers and therefore cause no pain External hemorrhoids occur below the dentate line in an area supplied by sensory pain fibers if they become thrombosed they produce severe pain The blood that is associated with hemorrhoids is bright red this is seen on the toilet tissue or in the commode The bleeding may disappear and not reappear for varying periods of time A hard or voluminous stool, usually following a period of constipation causes the blood to reappear Anemia may be absent or severe Because of the paucity of symptoms these cases are often neglected.

Cryptitis fissure-in ano ischiorectal abscess and fistula in ano are considered together since they are frequently related. Some are of the opinion that a fistula in-ano is the fourth or last stage of a cryptitis.

Cryptitis

Tiny little crypts of Morgagni encircle the rectum just inside of the anal canal at the dentate line These are indentified easily on anoscopic examination. The etiology of cryptitis is still moot however some are of the opinion that it results from broken-off bits of constipated stool which become entrapped in the crypt. Others blame plugged anal glands which are associated with these crypts In either event stasis plays an important role. Cryptitis produces anal spasm, painful defecation pruritus ani and tenesmus Anoscopic examination reveals an inflamed circular area representing the base of the crypt and frequently an elongated inflamed papilla directly in continuity with it.

Fissure in Ano

This represents the most frequent cause of painful rectal bleeding It is a break in the anal skin which frequently fails to heal. An associated infected crypt always should be sought for The pain produces sphincteric spasm which leads to further constipation, and a vicious circle results. Almost all anal fissures occur at the posterior commissure this would correspond to the 6 o clock location when the patient is in the lithotomy position (Fig 151) The pain is quite characteristic in that it is sharp and tearing and is initiated by a bowel movement Bleeding appears as a spot of fresh blood seen upon the toilet tissue or upon the stool

Anal ulcer is the result of repeated attacks of anal fissure. The pain now becomes more intense and continuous. Examination reveals instead of the linear abrasion characteristic of the fissure an oval undermined loss of continuity of the lining of the anus. External to this the characteristic "sentinel tag" is noted This results from an edema of the marginal skin due to blockage of the lymphatics and has been referred to errone-

ously as a sentinel pile' It is not a hemorrhoid Infected adjacent anal crypts may undermine the ulcer Such infected crypts are important both diagnostically and therapeutically (Fig 152)

Ischiorectal Abscess

This common and painful infection usually results from an infected crypt Such abscesses may be divided into those that occur above or below the levator ani muscles

The so-called **deep or supralevator infections** are fortunately the uncommon variety They occur in a space bounded by the levator muscles below, the wall of the rectum medially, and the peritoneum above Since this space is situated away from the sensory nerve supply, localizing symptoms appear notoriously late Peritoneal irritation may be produced and such cases have even been mistaken for acute appendicitis

The **superficial or infralevator type of abscess** is the one encountered most commonly The clinical manifestations consist of severe local pain and tenderness which produce rapid and complete disability The patient prefers to lie on his side or abdomen Fever and leukocytosis usually are elevated Physical examination reveals an area of redness and induration in the involved buttock Rectal examination is frequently impossible because of the severe spasm and pain If an ischiorectal abscess breaks into the rectum or through the outside skin on the gluteal surface immediate relief is obtained, and the acute symptoms disappear spontaneously When an ischiorectal abscess communicates with the exterior through the gluteal skin a fistula in-ano results

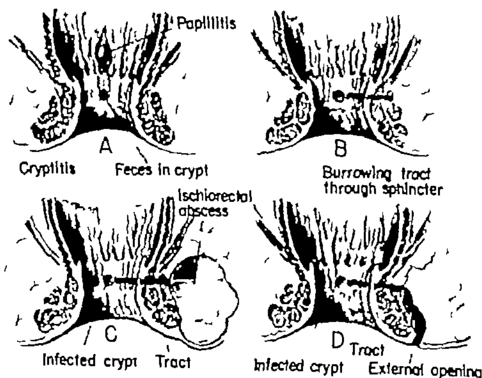


Fig 152 The 4 stages in the development of a fistula in ano (A) The cryptitis-papillitis stage usually is associated with constipation (B) Burrowing of the infection may pass above below or through the sphincter muscle (C) Infection in the fatty ischiorectal space leads to the development of an ischiorectal abscess. (D) The ischiorectal abscess after rupturing gives rise to the fully developed fistula in-ano

Fistula in Ano

It is helpful to consider this condition through 4 stages in its development (Fig 152)

Stage *1* Cryptitis
Stage *2* Burrowing
Stage *3* Ischiorectal abscess
Stage *4* Fistula in ano

A fistula in ano frequently starts as an infected crypt. For total eradication of such fistulas the entire tract and the involved crypt must be removed An infected crypt burrows either above or below the levator ani An ischiorectal abscess then develops This finally communicates with the external or gluteal surface either spontaneously or surgically and the fully developed fistula in-ano is formed Occasionally the infection spreads throughout the tissues of the perineum and produces numerous openings (waterpot type) Rectal strictures may develop The symptoms besides those of recurrent abscesses consist of a continuous annoying discharge pain and systemic evidence of infection occur Bowel movements are painful. The lesion varies in extent and location The communication with the rectum may be microscopic and difficult to determine because of healing of the infected crypt If the fistula is distal to the sphincter ani it is subcutaneous however, these tracts may course through or above the sphincter muscles Formerly such fistulas were thought to be associated with tuberculosis but such cases are rare

Benign Stricture of the Rectum

This acquired condition may follow trauma radiation therapy particularly of the cervix uteri or may result from specific diseases especially lymphogranuloma venereum The symptoms of an associated abscess may overshadow the underlying cause

Clinical manifestations are characterized by the passage of pus mucus and blood in the stool later symptoms are obstructive ones Those cases associated with the venereal disease known as lymphogranuloma venereum usually have a primary lesion located on the vulva, the pubis within the vagina or the rectum Nodes about the lower rectum become the site of secondary involvement. Perirectal abscess formation and mucosal ulceration occur which give rise to strictures. This latter condition is due to a specific virus from which a worthwhile antigen may be prepared The Frei test is a valuable diagnostic aid which should be utilized in all suspected cases of benign stricture of the rectum

Rectal Prolapse

The etiology is unknown however two possible factors have been mentioned, namely, a loose fixation of the rectum and a deep cul-de-sac. If the anterior rectal wall prolapses it may bring with it a downward projection of the peritoneum containing loops of small intestine The condition usually is seen in infants or in the aged it is more common in women. Venous obstruction which results from contraction of the anal sphincter produces marked congestion. This makes reduction difficult or impossible and necrosis may develop

Carcinoma of the Rectum

This condition is as frequent as the combined cancers of the rest of the colon. It appears between the rectosigmoid junction and the anus (anal carcinoma is of the squamous type) The growth may be silent, but in the majority of cases *bleeding* is the first sign The blood varies in color depending upon the length of time it remains in the rectum It is usually bright red.

Change in bowel habit may precede bleeding and is a symptom that warrants immediate investigation A sense of incomplete evacuation looseness of the stool or a frequent desire to defecate must be considered as carcinoma until proved to be otherwise. This is particularly true of the patient with hemorrhoids, since both the patient and the physician may be guilty of

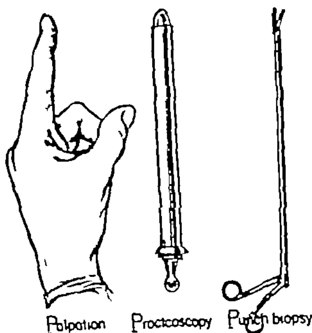


FIG. 153 Every patient with an anorectal or bowel complaint is entitled to the simple and accurate three "P" examination (palpation, proctoscopy and punch biopsy)

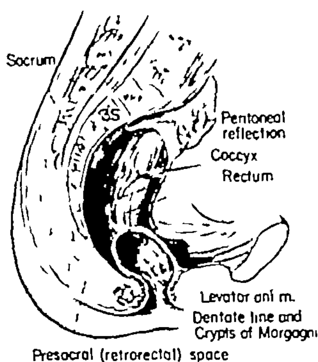


FIG 154 The presacral (retrorectal) space

attributing these signs and symptoms to the piles

Obstructive symptoms are the first manifestation if the tumor encroaches upon the bowel lumen. Cramping pain in the left lower quadrant and distention occur (See Intestinal Obstruction p 161) Total obstruction is rare in carcinoma of the rectum proper however it does occur when the tumor is located at the rectosigmoid junction Loss of weight anemia, and pain in the region of the sacrum are manifestations of late carcinoma.

Diagnosis *Every patient is entitled to digital and proctoscopic examinations* (Fig 153) Though roentgenologic studies are of great value in diseases above the rectosigmoid little reliance should be placed on these technics in a patient with rectal carcinoma.

Since these lesions are well within reach of the examining finger it is incumbent upon the physician to assume full responsibility for the identification of the tumor and institution of early therapy

Carcinoma of the Anus

This carcinoma is of the squamous cell type It is rare, occurring only 1/20th as common as carcinoma of the rectum

It differs from carcinoma of the rectum in many respects Because of its location, near the anal sphincter and in an area richly supplied with pain fibers, pain and anal spasm are early and significant symptoms These lesions are prone to early infiltration of the perirectal connective tissue and the vaginal wall They metastasize to the inguinal lymph nodes in contradistinction to carcinoma of the rectum which spreads to the deeper pelvic nodes Bleeding is usually present The prognosis is poor

Retrorectal Tumors

These are extrarectal tumors that occur in the presacral (retrorectal) space They are important because they are more common than was previously thought Many of these masses are asymptomatic however they may be associated with draining sinuses or fistulas

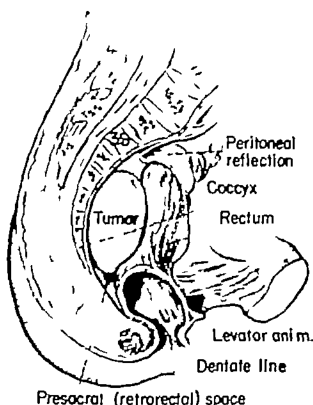


Fig 155 A mass involving the presacral space and causing pressure and bulging of the posterior rectal wall

The presacral (retrorectal) space has the following boundaries (Fig 154) anteriorly the rectum posteriorly the sacrum and the coccyx cephalad the peritoneal reflection which is usually at the second or the third sacral segment caudad the levators ani laterally the peritoneal reflection and the lateral rectal stalks This space contains branches of the sacral and the sympathetic nerves the middle sacral ileolumbar and middle hemorrhoidal vessels and lymphatics

The number of conditions that involve this space are 5 (1) inflammatory (2) congenital (3) neurogenic, (4) osseous and (5) miscellaneous

The inflammatory mass is by far the most common Infected dermoids and teratomas are not included in this group These masses can result from an infected crypt of Morgagni which spreads upward into the space (Fig 155) Such an abscess may rupture higher up in the rectum or may drain through its primary source. Chemical tumors (oleomas) result from the injection treatment of hemorrhoids or prolapse The mineral oil base in these solutions is the offender

Symptoms vary from low back pain to a feeling of fullness and pressure in the rectum, in some instances a purulent discharge from the anal canal is noted Proctoscopic examination reveals a bulging into the rectum this is covered by a normal mucosa. In some instances a draining sinus in the posterior wall of the anal canal may cause confusion A definite diagnosis is arrived at on examination with the patient under anesthesia and exploration or biopsy of the mass. The prognosis for patients with inflammatory tumors is excellent, since adequate drainage results in cure

Congenital tumors constitute the greatest number of retrorectal neoplasms. These consist of chordomas teratomas, dermoid cysts and meningoceles *Chordomas* are fetal remnants of the notochord. Dysfunction of the bladder is a constant complaint. Pain is present in the rectal the gluteal, the low back or the perineal areas this may extend along the sciatic nerve Roentgenologic study reveals destruction of the sacrum and the lower sacral segments if the lesion is large. *Teratomas* have been referred to as Middeldorpf tumors These represent more than one germ layer and are complex in structure, containing such materials as bone cartilage muscle, teeth, nerve, fat and intestinal mucosa. This type of tumor is seen most often in infants and newborns. On occasion a proctoscopic examination may reveal a protruding tooth or bone. The prognosis is poor since complete removal is seldom accomplished because of size secondary infection and extension into adjacent structures

Dermoid cysts frequently constitute the etiologic basis for so-called recurrent fistulas. These cysts rarely produce symptoms until they have become infected The dif

ferential diagnosis is concerned principally with anorectal fistulas Roentgenologic studies of the bony region may show the result of pressure erosion on the anterior aspect of the sacrum Prognosis as to life is good but the condition is resistant to therapy and repeated surgical interventions may result in rectal incontinence

NEUROGENIC TUMORS

These tumors have their genesis in nerve tissue and are either neurofibromas or neurilemmomas The radiologist may demonstrate erosion of the sacral canal or the sacral foramina Although frequently asymptomatic they may cause pain along nerve roots which is accompanied by dysfunction of the rectum and the bladder The prognosis is good if the tumor is removed completely Ependymomas arise from the cauda aquina Pain is marked and referable to nerve root irritation producing rectal and vesicle dysfunction The prognosis of these tumors is not good The prognosis of neurilemmoma, however, is better

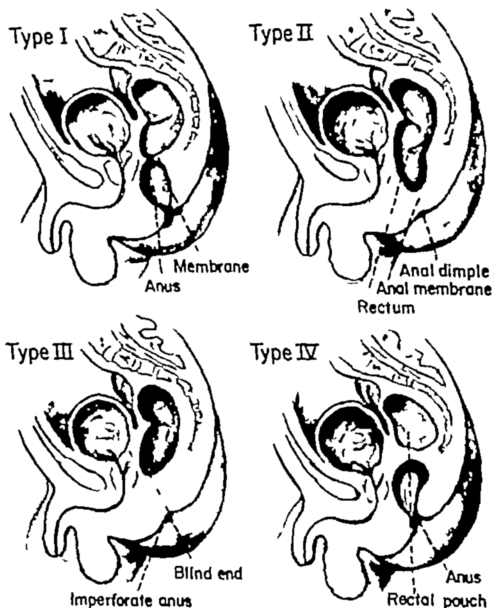


FIG 156 Congenital malformations of the anorectal region

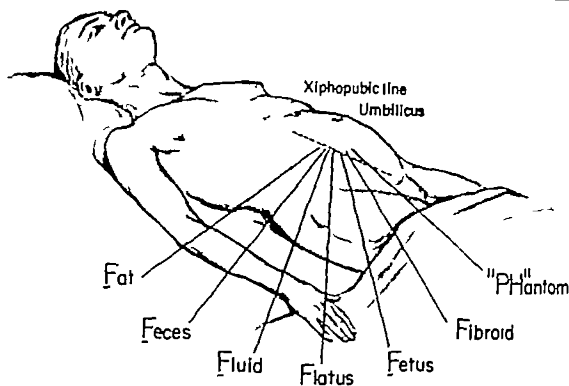


FIG 158 The 7 F's in the differential diagnosis of abdominal distention.

important diagnostic factor In infants intussusception and congenital anomalies are the chief causes of obstruction in young adults the most frequent cause is postoperative adhesions in later life neoplasms constitute the usual cause

Diagnosis

Intestinal obstruction is *not* a disease It is a symptom complex. A proper diagnosis can be made after obtaining an answer to the following 4 questions

1 Is this an intestinal obstruction?

2 Is this a large bowel or small bowel obstruction?

3 Is this a strangulated or nonstrangulated obstruction?

4 Is this a complete or incomplete obstruction?

Question No 1 Is this an intestinal obstruction?" Nearly all of these patients at some time in the course of the disease experience pain, vomiting distention and/or obstipation However these findings may be present only in part or may be lacking.

Pain synchronized with sound is the most pathognomonic finding in intestinal obstruction When pain and audible peristalsis (stethoscope) occur simultaneously intestinal colic is present No other colic will produce this

Distention of the abdomen is usually present unless the obstruction is very high or if the bowel can be emptied distal to a large bowel lesion. "What is distention?" Since no anatomically adequate definition has been found the author prefers to utilize the anatomy of the anterior abdominal wall as an index to distention (Fig 157) If an imaginary line is drawn between the xiphoid and the symphysis pubis it will be noted that the umbilicus normally lies beneath (dorsad) this xiphopubic line This is a *scaphoid* abdomen. If the umbilicus is on the xiphopubic line the abdomen is described as being *flat* If the umbilicus is above the xiphopubic line the abdomen is *distended*. If we utilize this method, we have a specific diagnostic aid that is most accurate in discover

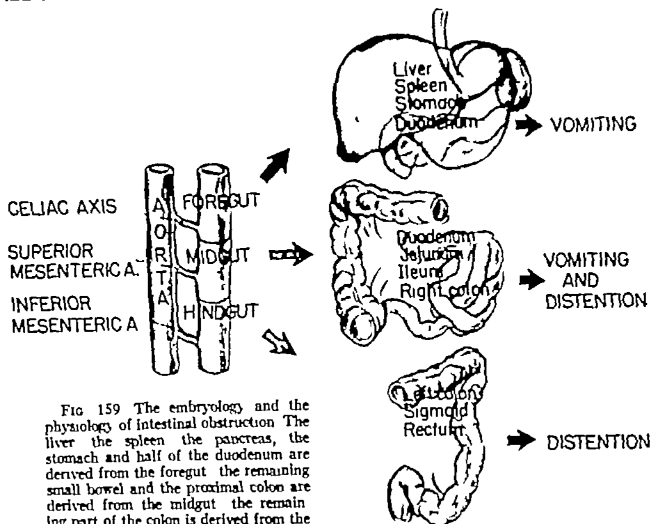


FIG 159 The embryology and the physiology of intestinal obstruction The liver the spleen the pancreas, the stomach and half of the duodenum are derived from the foregut the remaining small bowel and the proximal colon are derived from the midgut the remaining part of the colon is derived from the hindgut. If an obstruction involves that part of the gastro-intestinal tract that is derived from the foregut, then vomiting is the outstanding symptom, if midgut bowel is involved then both vomiting and distention are present if that part of the colon that is derived from the hindgut is involved then distention is the outstanding finding

ing early distention and its progress If the umbilicus is on or above the xiphopubic line —in other words if an abdomen is flat or distended — the differential diagnosis includes the 7 F's" namely Fat, Feces Fluid Flatus Fetus, Fibroids and Phantom" tumors (Fig 158)

Obstipation or the absence of bowel movements may be present or absent in intestinal obstruction If the obstruction is incomplete both flatus and feces will pass per rectum Early in the course of a complete obstruction the intestinal contents may be expelled distal to the lesion either spontaneously or with an enema thus giving the patient relief, and the doctor a degree of false security In some incomplete strangulated obstructions as occurs in Richter's hernia only part of the circumference of the bowel is strangulated In such cases diarrhea a result of hyperperistalsis, may be present

Vomiting if interpreted properly is a helpful diagnostic aid Dogma may be dangerous however when reasonably applied it serves the purpose of emphasis. Patients with large bowel obstructions do *not* vomit, but patients with small bowel obstructions *do* vomit There are exceptions to every rule any organ that twists on its base might produce vomiting Therefore large bowel

obstructions due to volvulus (sigmoid and transverse colon) may be associated with vomiting The higher (cephalad) the lesion, the earlier the vomiting This will be dis cussed in detail under Question No 2

Abdominal auscultation is not only im portant *in discovering synchronization of* pain and sound but it also aids in the identi fication of abnormal bowel sounds that are diagnostic of obstruction Normally, intesti nal sounds are heard as clicks or gurgles but in intestinal obstruction distinct metallic tinkles can be heard which are called *ob structive borborygmi* These are pathognomonic of intestinal obstruction If intestinal sounds are totally absent, one must suspect bowel paralysis from toxemia or peritonitis.

Question No 2 "Is this a large bowel or a small bowel obstruction?" In the vast majority of cases if vomiting is an early and outstanding symptom the patient has a *small bowel obstruction. Vomiting is a late* and unimportant complaint in patients who have a large bowel obstruction however distention is present early (Fig 159) The vomitus first consists of gastric contents, then bile, then the contents of the upper intestine and finally contents of the terminal ileum. The last has a distinct fecaloid odor and appearance The word fecal vomiting



Fig 160 Flat roentgenogram demonstrating the absence of gas in the true pelvis This is suggestive of a complete intestinal obstruction.

should not be used since this is not true feces that the patient vomits When true fecal vomiting occurs it is pathognomonic of a gastrocolic fistula Vomiting is not present in colonic obstruction because most people have a competent ileocecal valve The *flat roentgenogram* is a most useful adjunct in differentiating large bowel from small bowel obstructions The film should include the diaphragm and the pelvis It should be taken as soon as intestinal obstruction is suspected and before nasogastric siphonage or enemas are started Gas in the ampulla of the rectum (sacral area) is absent when a complete mechanical obstruction exists (Fig 160) This is particularly true if this is present after an enema is given Normally gas is not present in the small bowel except in infants aged patients and air swallowers When gas is present in the small bowel it usually assumes a "stepladder" pattern (Fig 161) Small bowel is identified further by the fact that the transverse striations (valvulae conniventes) extend completely around the intestines In large bowel obstruction the roentgenogram reveals a horseshoe or inverted "U" arrangement if the obstuction is on the left side (Fig 162) This is due to distention of the descending the transverse and the ascending colons The large bowel can be identified further on the roentgenogram in that it occupies the lateral aspects of the abdomen, it runs in a vertical direction (with the excep-



Fig 161 Flat roentgenogram demonstrating a "stepladder" pattern in a case of small bowel obstruction

tion of the transverse colon) and the incomplete transverse striations and haustrae are demonstrable When isolated segments of bowel are noted on the roentgenogram particularly small bowel one should suspect acute pancreatitis (p 212) If an acute inflammatory process can be ruled out, and if peritonitis is not present, a barium enema may be given to obtain specific isolation of a large bowel lesion The usage of barium by mouth is dangerous

The *history* is helpful in differentiating large bowel from small bowel obstructions A slow progressive chronic increasing constipation suggests a large bowel obstruction whereas an acute violent attack of pain with obstruction signifies a small bowel obstruction The presence of a scar on the anterior abdominal wall from previous abdominal surgery is strong evidence in favor of a small bowel lesion The author has not seen a large bowel obstruction caused by postoperative adhesions although these have been reported, they are extremely rare.

Question No 3 Is this a strangulated or nonstrangulated obstruction?" Strangulation rarely occurs in large bowel obstructions with the exception of volvulus. When strangulation is present *tenderness* can be elicited at the site of the lesion. This must



FIG 162 Flat roentgenogram demonstrating the inverted "U" or horseshoe pattern in a large bowel obstruction caused by a carcinoma of the rectosigmoid.

not be confused with pain Strangulation, if untreated, results in shock When a segment of bowel becomes strangulated both intra intestinal and intraperitoneal hemorrhage occur A strangulated loop of bowel may be detected by the roentgenogram because it appears as an isolated loop and assumes a vertical position Since blood is present in its lumen the characteristic valvulae con niventes are absent (Fig 163)

Question No 4 'Is this a complete or incomplete intestinal obstruction?" In a complete obstruction neither flatus or feces passes per rectum. The exceptions to this have been stated The so-called 'scout" roentgenogram of the abdomen is particu larly helpful in that no gas is noted in the true pelvis (Fig 160) These patients look very sick and deteriorate rapidly if treat ment is delayed

Laboratory findings are of little help in the diagnosis of bowel obstruction Urinaly sis may aid in revealing sugar albumin or a ketonuria The blood reveals changes in dicative of dehydration if this is present A rise in the red and the white blood cell counts, the hematocrit and the hemoglobin also reveal dehydration There is a marked loss of chlorides Alkalosis is determined by an increased CO_2 combining power



FIG. 163 Flat roentgenogram demonstrating a strangulated loop of small bowel

SPECIFIC CAUSES OF OBSTRUCTION

Intussusception. This is a telescoping of one portion of the bowel into another When an intussusceptum has been drawn into its intussuscipiens the process will be a progressive one until relief is obtained or death supervenes

INCIDENCE. Intussusception is one of the most frequent surgical emergencies in infancy In adults it usually results from some abnormality such as a tumor but in child hood and infancy such factors are usually lacking

CLASSIFICATION It is helpful to divide intussusceptions into simple and mixed varieties (Fig 164) The simple include enteric, ileocolic, ileocecal and colic. The mixed include ileocecal and ileo-ileal and double In the ileocolic type the ileum prolapses through the ileocecal valve, which remains at a relatively fixed point. In the ileocecal variety however, the ileocecal valve and/or the adjacent cecum is the spearhead and invaginates the ascending colon drawing the ileum behind it (Fig. 165)

Intussusception has also been classified as acute, subacute and chronic. These variations are due to the relative looseness or tightness with which the intussusceptum is

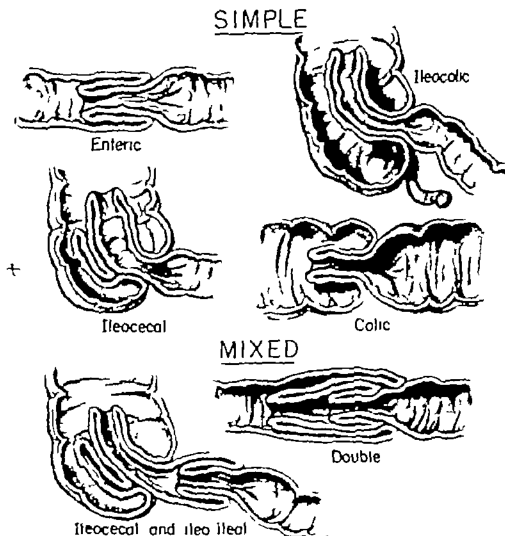


FIG. 164 Classification of Intussusception

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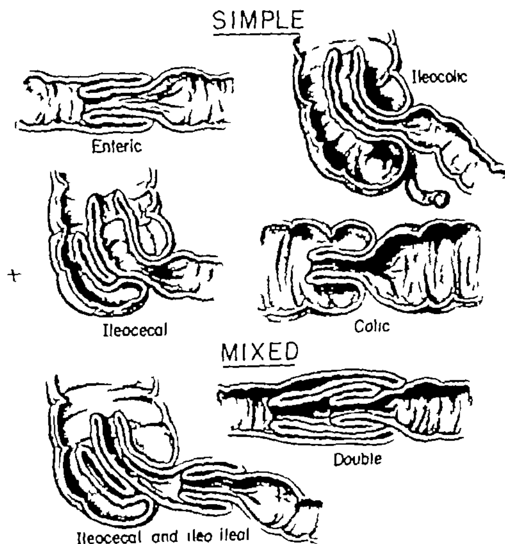


Fig 164 Classification of Intussusception

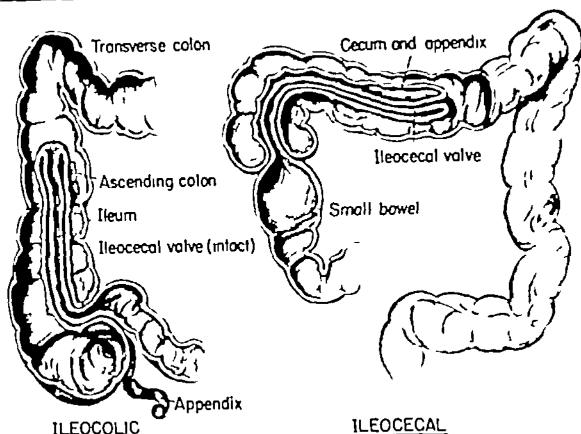


FIG. 165 In the ileocolic type of intussusception the ileocecal valve remains in its normal fixed position In the ileocecal type the ileocecal valve acts as the moving spearhead.

held by the intussuscipiens The tighter it is held the greater the constricting effect upon the mesentery and the more rapid is the development of strangulation and necrosis

SYMPTOMS The symptoms vary somewhat in children and adult In adults the symptoms are those of partial or complete bowel obstruction and are associated with abdominal cramps nausea and vomiting Bowel movements may be normal and at times a *diarrhea is present There is little or no evidence* of tenderness or peritoneal irritation since the involved or necrotic intussusceptum is encased within the essentially normal intussuscipiens thus protecting the general peritoneal cavity A mass is usually palpable Rectal examination frequently reveals so-called *"currant jelly feces"* on the gloved finger this is due to an admixture of blood and mucus When the intussusception is enteric, there is usually roentgenologic evidence of a small bowel intestinal obstruction (p 162) These findings may or may not be present when the condition involves the colon Barium enema in these cases reveals an obstructing lesion at the apex of which the so-called "coiled spring" pattern may be seen This results from the barium streaking between the layers of the intussusceptum and the intussuscipiens

When children are affected the parent *notices that the child becomes pale, doubles* up and draws his legs up because of severe pain After the paroxysm ceases the child resumes a playful attitude and appears to be quite normal but later he has a recurrence of the painful episode As the obstruction progresses pallor sweating dehydration and shock appear In rare cases the intussusceptum may protrude from the anus This is differentiated from rectal prolapse

by passing a finger into the rectum and then between the intussusceptum and the surrounding anal sphincter In a prolapse of the rectum such a maneuver is impossible because no such space exists

There are cases of congenital polyposis of the gastro-intestinal tract primarily involving the small intestines which are associated with dark pigmented melanin spots of the buccal mucosa, the hard palate and the lips These spots look like freckles but are darker they may be found also on the fingers and the toes The two associated lesions comprise a syndrome which is familial in nature inherited as a mendelian dominant. These cases are predisposed to intussusception

VOLVULUS

Volvulus consists of a twist (torsion) of a loop of intestine around its mesentery It

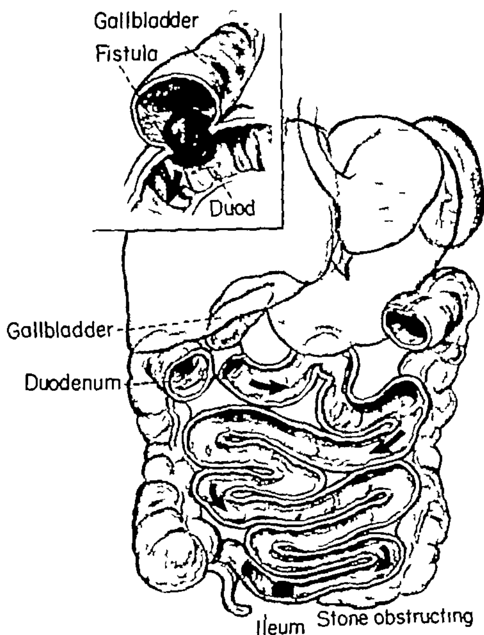


Fig 166 The physiopathology of gallstone ileus.

occurs more frequently in the colon than in the small intestine

Volvulus of the Sigmoid

This twist is most likely to occur in patients who have a long sigmoid loop and a narrow mesenteric attachment Because of this the bowel rotates around the fixed point Cases become subacute and recurrent if the loop rotates and then returns to its normal position The direction of rotation varies

Signs and symptoms of intestinal obstruction are present the distention may be enormous Vomiting is an early symptom this differs from other types of *large* bowel obstruction Tenderness in the left lower quadrant appears when the blood supply is interferred with and gangrene develops The roentgenogram usually presents a large loop of bowel rising out of the pelvis which is tremendously distended Absence of fluid levels and the loss of haustral markings are most suggestive The ace of spades sign becomes apparent as barium enters the region of the twist

Volvulus of the Cecum

This designation is misleading because in almost all of these cases some part of the terminal ileum and the ascending colon are also involved In most cases the rotation is in a clockwise direction The clinical picture is that of bowel obstruction however in the recurrent type the symptoms may be confused with acute appendicitis The anatomic prerequisite for such volvulus is abnormal mobility of the cecum and the ascending colon A roentgenogram that reveals a dilated cecum abnormally placed should make one suspicious of this condition Tenderness over the massively dilated cecum is usually present

GALLSTONE ILEUS

The occurrence of this condition is relatively rare It is a type of small bowel obstruction that occurs in the later years of

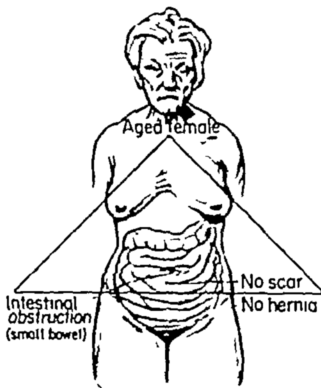


Fig 167 Gallstone Ileus can be diagnosed if this triad is apparent.

life (sixth decade and later) The calculus usually gains entrance to the small bowel following the development of a cholceystoduodenal fistula Such a fistula is the result of repeated attacks of cholecystitis, plus pressure necrosis from a gallstone (Fig 166) Almost all stones become impacted in the distal ileum because the lumen is smallest here As the stone travels distally in the bowel it may become engaged temporarily and then disengaged then the obstructive signs and symptoms would alternate also A correct diagnosis of gallstone ileus can be made in most instances preoperatively This is possible if the following desiderata are met (Fig 167)

1 The patient is past the sixth decade (usually a female)

2 Signs of small bowel obstruction are present.

3 No scar on the abdomen from previous surgery or visible external strangulated hernias.

If one is fortunate enough to have a flat

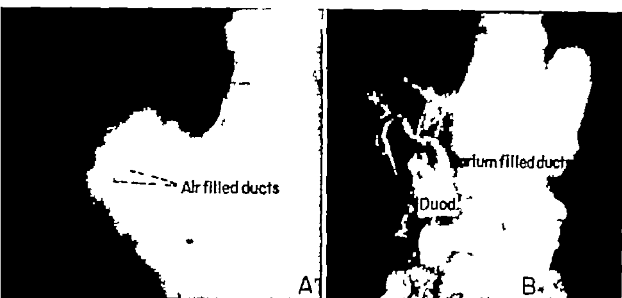


Fig 168 Roentgenogram of a spontaneous cholecystoduodenal fistula.

roentgenogram that reveals air or contrast media in the biliary tract the diagnosis of cholceystoduodenal fistula is definite (Fig 168)

MESENTERIC VASCULAR OCCLUSION

Occlusion of the mesenteric vessels may involve either the artery or the vein often a combination exists The picture of intestinal obstruction usually develops

Mesenteric venous occlusion accounts for over three fourths of the cases of mesenteric occlusion There is usually a history of some infection (appendicitis, diverticulitis peritonitis or thrombophlebitis) There may be a prodromnal period in which intermittent colicky abdominal pain has been present. When the bowel becomes devitalized the pain becomes intense and continuous Such occlusion may involve the accompanying artery Melena is usually present. Of impor

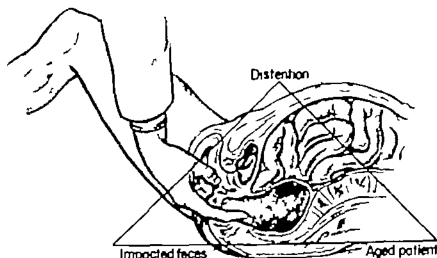


Fig 169 Fecal impaction should be suspected in the aged patient with large bowel obstructions.

tance is exquisite abdominal tenderness over the involved segment however, rigidity may be absent Shock or impending shock is common Blood noted with the rectal exami nation may give the first clue The flat roentgenogram reveals an indefinite small bowel gas pattern or isolated loops in which the valvulae conniventes are obliterated

Mesenteric arterial occlusion is present in either elderly patients with cardiovascu lar disease or in young patients with valvu lar heart conditions The onset is sudden and dramatic with severe abdominal pain The degree of shock is dependent upon the severity and the extent of the occlusion Bowel sounds disappear rapidly and the abdomen becomes distended Signs and symptoms of intestinal obstruction develop In the absence of a scar on the abdomen or a visible strangulated hernia mesenteric thrombosis must be considered seriously It must be differentiated from gallstone ileus (p 171)

Endometriosis involves the small and/or the large intestine It can produce intestinal obstruction and since it is a benign condi tion that exhibits marked infiltrative ten dencies it is readily mistaken for a malig nant lesion *Acquired dysmenorrhea* and/or *acquired dyspareunia* are particularly sug gestive of endometriosis Menstrual irregu larities might also be present If the sigmoid is involved, it may be narrowed but the mucosa appears to be normal The possi bility of this condition must be kept in mind in every case of intestinal obstruction in women between the ages of 30 to 50 Since the prognosis is good and the surgical mor tality is low, such patients should be ex plored in the hopes of finding this benign condition

Irradiation may be the cause of a stenos ing and obstruction lesion of the bowel Fre quently the sigmoid and the terminal ileum are involved When a history of irradiation is obtained and when signs and symptoms of bowel obstruction are manifest one should keep this possibility in mind

Regional enteritis has been discussed elsewhere (p 124) It must be considered in cases of bowel obstruction particularly those involving the small intestines

Internal hernias can produce bowel ob structions however the incidence of these is less than 1 per cent The mortality is high because a large percentage of these cases are associated with early strangula tion and the diagnosis is delayed

Fecal impaction can cause a large bowel obstruction particularly in older patients (Fig 169) It is most embarrassing when this common condition is overlooked par ticularly if the patient is operated upon unnecessarily Such obstructions are rarely acute and the diagnosis is made readily by rectal examination The flat roentgenogram shows a mottling (fecal masses) of the large bowel

Miscellaneous causes Numerous other conditions may cause bowel obstructions Such conditions include enteroliths worm balls trichobezoars phytobezoars and for eign bodies Their presence must be kept in mind

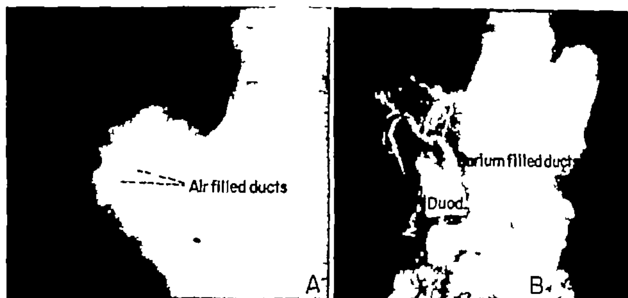


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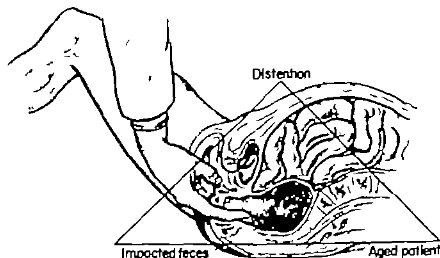


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7

Liver, Gallbladder and Bile Ducts

Numerous functions and chemical processes take place within the liver despite the fact that it has only one specific cell—the polygonal cell (Fig 170) The functional derangement and the degree of disturbance depend upon the nature and the severity of the disease as well as the stage in which it is studied To add to the difficulty of such a study there is the fact that hepatic functions vary in different phases of a disease and in different patients For these reasons no single test can be relied upon

LIVER FUNCTION TESTS

Hepatic tests should be used in groups. Repetition of these tests is necessary since they vary from day to day with no apparent change in the clinical condition It must be emphasized that the hepatic tests are not specific for any particular type of hepatic disease but are utilized as an adjunct to determine the presence of hepatic pathology

The table of tests on page 176 although not all inclusive is recommended

When these values are altered the liver should be suspected of having sustained some damage These laboratory data do not replace the history and the physical examination

Palpation. The liver normally is not palpable in the adult but may be felt readily

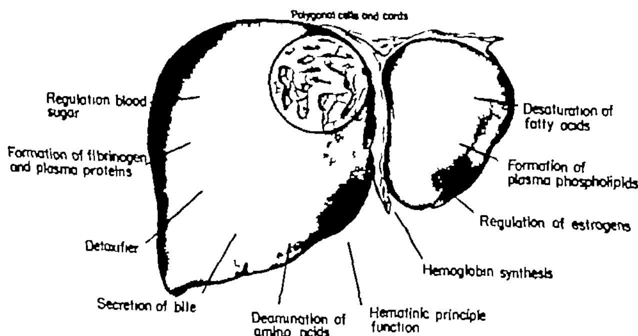


FIG 170 The liver performs many important functions. Some of these are depicted here.

TABLE 2 HEPATIC TESTS

TEST	NORMAL VALUE
Bromsulphalein	0 to 5% retention at end of 40 minutes
Cephalin-cholesterol flocculation (Hanger)	0 to 1+ (at 48 hours)
Thymol turbidity	0 to 3.0 units
Urine bilirubin	0 to 0 25 mg. per 100 cc.
Urine urobilinogen	1 0 Ehrlich units (2 to 4 p.m. specimen)
Cholesterol, total	*140 to 250 mg. per 100 cc.*
Cholesterol esters	60 to 75% of total
Alkaline phosphatase	1.5 to 4 0 Bodansky units
Serum protein	
Total	6 5 to 8.0 Gm. per 100 cc.
Albumin	4 0 to 5.5 Gm. per 100 cc.
Globulin	1.5 to 3 0 Gm. per 100 cc.

when the organ is enlarged or displaced It is palpated best from below upward starting in the right lower quadrant and progressing upward toward the right costal arch. A *Riedel's lobe* is a tonguelike projection which juts forward and appears in the right upper quadrant (Fig 171) It may simulate an enlarged gallbladder or tumor of the liver Also, *tendinous inscription* in a well-developed right rectus muscle has been mistaken for a pathologic liver or gall bladder These conditions usually can be differentiated if the patient is examined in the supine position with the knees elevated the arms at the side, and breathing through the open mouth.

Biopsy Particularly to be condemned as a diagnostic aid is the so-called 'blind" liver biopsy With so massive an organ as the liver one wonders how often correct

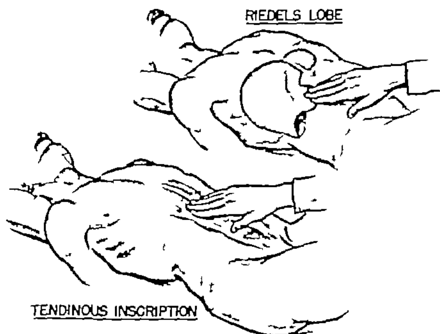


FIG. 171 A Riedel s lobe or a tendinous inscription may be mistaken for a diseased liver or gallbladder

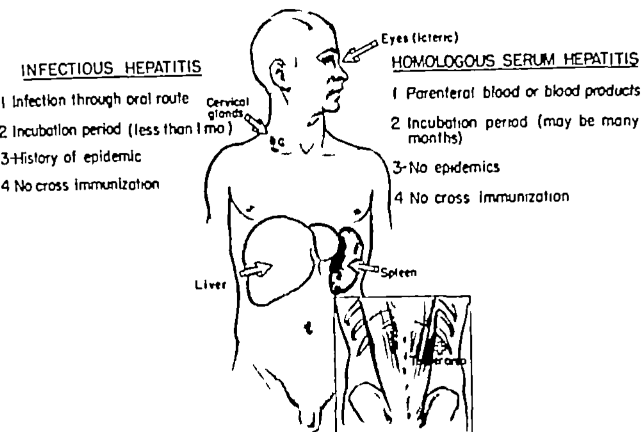


FIG 172 Infectious hepatitis or homologous serum hepatitis? Some of the diagnostic and differential diagnostic features are tabulated in the illustration

information can be obtained by taking a minute specimen The method is not without danger It is true that many favorable reports have appeared in the literature regarding the advantages of this method however whenever possible exploratory laparotomy is the method of choice If a biopsy is taken during the course of the laparotomy one can at least see what is being biopsied evaluate the macroscopic appearance of the involved organ and determine operability This is impossible with the "blind" method

HEPATITIS

"Hepatitis" can be defined in a broad sense as damage to the liver cells which results from such etiologic agents as viral, chemical, physical bacterial or protozoal Some authors also include the reactive and the reparative phenomena Those forms of hepatitis due to a transmissable filterable agent are undoubtedly the most prevalent ones These are the infectious types

The two types that are of surgical interest are infectious hepatitis and homologous serum hepatitis Whether these are one and the same condition produced by a specific virus or entirely different entities which present a similar clinical picture is unknown (Fig 172)

The infectious hepatitis virus gains entrance to the body through the oral cavity with ingested contaminated foods Contamination is usually brought about by contact with contaminated feces or urine Also droplet infection may be an etiologic factor The incubation period is usually less than 1 month it unquestionably occurs in epidemics A skin test has been devised which gives a uniformly positive response in patients who have had this disease

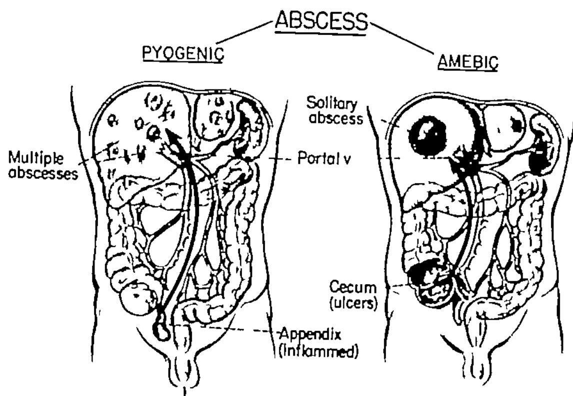


FIG 173 Liver abscesses may be pyogenic (appendicitis, etc.) or amebic (*Enda moeba histolytica*) The infection usually travels to the liver via the portal vein.

Homologous serum hepatitis has a longer incubation period the symptoms appearing in 100 days or over This hepatitis is transmitted parenterally following the use of serum or blood products administered subcutaneously intramuscularly intravenously or pharyngeally (sprays) This disease does not occur in epidemics There is no cross immunity with infectious hepatitis

Clinical Picture Clinically these two conditions present the same signs and symptoms In the prodromal stage there are malaise aching sensations, particularly in the extremities, anorexia vomiting and constipation or diarrhea. Although visible *jaundice* is not present in all cases symptoms usually subside if and when the icterus reaches its height. Pain is usually present in the right hypochondrium this is increased by jarring or coughing Fever and chills may be present. Enlargement of cervical lymph nodes may be noted particularly on the right side. The liver is usually enlarged and tender to both palpation and percussion The spleen is occasionally palpable but reveals the enlargement when percussed If the condition becomes serious bleeding from the body orifices occurs nervous system symptoms appear and serious cardiovascular damage becomes evident. Ascites frequently make its appearance in those cases associated with fatal hepatitis.

Differential Diagnosis The anicteric form of hepatitis frequently masquerades as influenza It must be differentiated from other febrile conditions

The liver function tests may indicate parenchymatous liver damage The white blood count may be elevated and at times reveals a slight lymphocytosis

The differential diagnosis of this condition involves the differential diagnosis of jaundice (p 194) This is a medical rather than a surgical jaundice but must not be

confused with gallbladder disease or lesions involving the head of the pancreas and the common bile duct

The **prognosis** is comparatively good, since 95 per cent of cases of viral hepatitis recover fully The mortality is approximately 0 5 per cent From 4 5 per cent to 5 per cent of these patients acquire chronic sequelae such as chronic recurring hepatitis and portal cirrhosis (p 181)

LIVER ABSCESS

For practical purposes liver abscesses may be divided into 2 types pyogenic and amebic (Fig 173)

PYOGENIC ABSCESS

The pyogenic abscess is usually multiple and accompanies suppurative processes in the abdomen such as appendicitis and ulcerative colitis which produce pylephlebitis (thrombophlebitis of the portal vein) The offending organisms are usually hemolytic streptococcus and the colon bacilli however other organisms may play a part. The portal vein is usually the path of entry to the liver but the hepatic artery, infected bile ducts (cholangitis) or direct extension from adjacent organs also may be associated with the pathogenesis

The **symptoms** include weakness malaise fever and chills and mild pain in the right upper quadrant The pain may be referred to the right shoulder or the right side of the neck With the advent of pylephlebitis the signs of sepsis (chills fever and sweats) dominate the clinical picture If this extends into the right thoracic cavity chest pain and cough develop

Physical examination reveals liver enlargement and tenderness Jaundice is the exception Occult or hidden jaundice can be detected by a study of the serum bilirubin and the icterus index. A marked leukocytosis and secondary anemia are usually present The fluoroscopic examination aids in detecting an elevated or fixed right hemidiaphragm This must be differentiated from a subphrenic abscess (p 185) In *liver abscess* the roentgenogram (AP view) reveals obliteration of the cardiophrenic angle In *subphrenic abscess* the AP view reveals obliteration of the costophrenic angle, and the lateral view reveals an obliteration of the posterior costophrenic angle

Liver function tests are helpful The serum bilirubin and the alkaline phosphatase may be elevated

The **prognosis** is guarded Prior to the advent of chemotherapy and antibiotic drugs the mortality has been stated to be as high as 50 to 95 per cent However, due to modern therapy a more favorable outlook can be anticipated

AMEBIC ABSCESS

The amebic liver abscess is usually solitary It is encountered in both the temperate and the tropical climates The causative organism is the *Endamoeba histolytica* liver invasion is secondary to the intestinal disease There is no primary amebic hepatitis or amebic abscess of the liver It is likely that the causative agent reaches the right lobe of the liver via the cecum and the portal vein (Fig 174) The time interval between the onset of the intestinal disease and hepatic complications has been estimated as less than 6 months in rare instances and occasionally as long as 57 years Therefore any patient who has had intestinal amebiasis is always in danger of hepatic complications.

Clinical Picture Clinically the difference between amebic hepatitis and amebic abscess is quantitative rather than qualitative *Abdominal pain* is the most common symptom this is usually present in the right upper abdominal quadrant but may be generalized *Chest pain* is frequently present because of direct extension to the lungs or irritation of the diaphragmatic pleura Increased respiration affects the intensity of the pain Pleuropulmonary pain is more common with liver abscess than with hepatitis The pain may radiate to the

neck or the right scapula. *Physical findings* reveal liver tenderness and in most instances hepatomegaly Exquisite pinpoint tenderness is present with abscess formation Jaundice is infrequent.

Elevation of the right hemidiaphragm and limitation of its mobility may be seen fluoroscopically The degree of the latter does not differentiate amebic hepatitis from amebic abscess The stool should be examined for amebae The compliment fixation test is still of doubtful clinical value The pus if aspirated or expectorated in the case of fistula formation has the characteristic brick red color Liver abscesses regardless of cause may extend to the subphrenic spaces Empyema thoracis pneumonia, lung abscess, or pericarditis are fairly common

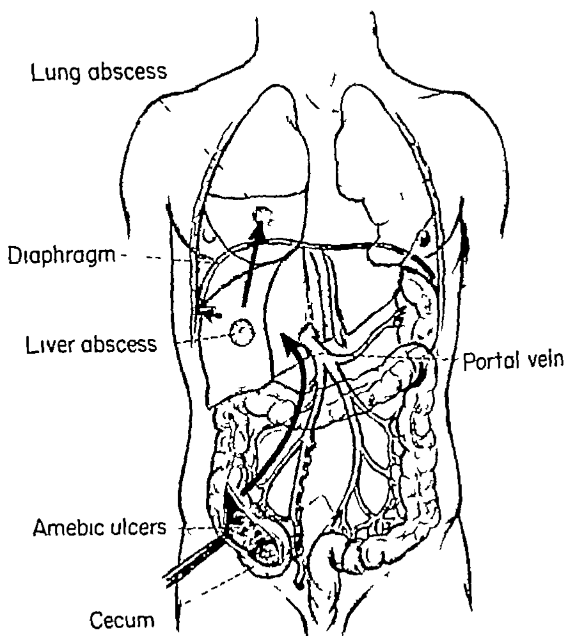


FIG. 174 The amebic liver abscess and its possible extension to the thoracic cavity

complications On occasion hepatic abscesses have ruptured into the thoracic duct or the inferior vena cava

CIRRHOSIS OF THE LIVER

Cirrhosis is considered here for 3 reasons it must be included in (1) the differential diagnosis of surgical diseases of the biliary tract (2) the evaluation of liver function in determining the patient s ability to withstand surgical procedures, and (3) the recognition of portal hypertension

Portal hypertension is particularly important since some encouraging results are reported currently with surgical therapy The hypertensive state in the portal system may be either intrahepatic or extrahepatic these are differentiated with liver function tests (p 176) The intrahepatic variety, which is more common is discussed here.

Incidence

Portal cirrhosis is seen most commonly in men between the fifth or the sixth decades of life The author has been impressed with the so-called cirrhotic habitus (Fig 150) This is the male who has little or no hair on his chest such males are predisposed to liver cirrhosis Although no definite etiology has been established, toxic factors such as chronic alcoholism and an associated dietary deficiency are suspected It is known however that this condition is seen also in the teetotaler

Clinical Features

Esophageal varices usually produce hemorrhage which can be mild, moderate or massive If severe, the picture of shock is present. At times these varices are associated with enlarged gastric veins in the fundus of the stomach they are demonstrable radiologically If tremendously enlarged they may produce dysphagia.

Hemorrhoids, in portal hypertension are one of Nature s many ways of transferring blood from the portal to the caval system Therefore, it is important to evaluate the condition of the liver in every case of hemorrhoids Avoid hemorrhoidectomy in males who present a nonhirsute chest until the liver has been studied thoroughly If hemorrhoidectomy is performed in cases of portal hypertension important portacaval anastomoses are interrupted and the patient may develop an ascites as a manifestation of portal decompensation

The history may reveal alcoholism, malnutrition, previous jaundice, hepatitis, or chronic exposure to hepatotoxic agents The size of the liver varies with the stage of the disease In early cirrhosis the liver is enlarged and palpable probably because of fatty infiltration its enlargement upward can be demonstrated by percussion As extensive fibrosis occurs the liver shrinks if palpable it presents a hard, slightly nodular feel In the late stage the characteristic atrophic hobnailed liver is present (Laennec s cirrhosis) Such a liver is not palpable unless ptotic. Liver function tests usually reveal severe damage

The spleen is enlarged in all types of portal hypertension but after an exsanguinating hemorrhage it decreases in size and may not be palpable It becomes palpable however, when the blood volume is restored In portal hypertension with splenomegaly there may be an accompanying anemia, leukopenia and thrombocytopenia This comprises the picture of so-called Banti s "disease" It is better to refer to this as Banti s syndrome This phase of portal hypertension is discussed on page 234 under the heading of "Secondary Hypersplenism"

The skin may present tell tale signs of hepatic disease *Jaundice* usually appears late it is rarely associated with pruritus Engorged abdominal veins are visible particularly around the umbilicus and over the lateral aspects of the abdomen Such venous networks are readily demonstrable with infrared photography *Spider naevi* are frequently present they are usually noted about the head and the neck. *Palmar erythema* are also suggestive of hepatic disease.



Fig 175 Roentgenogram of esophageal varices. The patient has been given barium by mouth and the characteristic "beaded" or "pearl necklace" appearance is demonstrated.

Ascites is associated with lowered osmotic pressure and hypoalbuminemia. It constitutes one of the most distressing symptoms The fluid is a transudate and is straw-colored Carcinoma must be ruled out.

Bleeding esophageal varices can be present in a patient with minimal evidence of cirrhosis The bromsulphalein clearance test is probably the most sensitive in the early phase of cirrhosis but it is of no value if jaundice is present The gamma globulin test is also sensitive and may be of value when combined with other tests

Diagnosis

Roentgenographic demonstration of esophageal varices should be attempted It has been our custom to examine these patients roentgenologically soon after or even during mild bouts of hemorrhage This, of course, must be done gently and expertly by one well trained in such cases Almost all hypertensive esophageal varices are in the lower regions of the esophagus near the esophagogastric junction When present, the typical so-called "beaded" appearance is demonstrable (Fig 175) Varices in the upper third of the esophagus are usually congenital

Endoscopy in the presence of hemorrhage has been advocated as a diagnostic aid It is mentioned here to be condemned This is far more traumatizing than a roentgenographic examination

Portal venography or roentgenographic visualization after filling one of its branches with a radiopaque medium is recommended also Time will prove its value

The differential diagnosis is of vital practical importance since the treatment differs tremendously in the various bleeding lesions of the esophagogastro-intestinal tract. The *most common* site is the gastroduodenal segment this constitutes the vast majority of cases. Peptic ulcer is a common cause of *massive* hemorrhage, whereas a malignant neoplasm rarely causes this kind of hemorrhage Other conditions which must be differentiated are hiatus hernia, severe hypertrophic gastritis blood dyscrasias and ulcerations from ectopic gastric and pancreatic tissues If blood is coughed up and not vomited it is frothy, bright red and alkaline to litmus paper The

surgical rarities and oddities have not been included in this differential diagnosis

BENIGN TUMORS

Primary tumors of the liver, benign or malignant are relatively rare The benign tumors include hemangioma adenoma, fibroma teratoma and the so-called lipoma Other tumors have been described how ever the two most frequent ones will be discussed namely benign hemangioma and adenoma

Benign hemangioma is found more fre quently in the liver than in any other in ternal organ In most cases it is small un productive of symptoms and frequently constitutes an incidental finding at surgery or necropsy These hemangiomas communi cate freely with the sinusoids of the liver hence they bleed briskly if incised Fre- quently they are associated with heman giomas of other organs particularly the skin If such a tumor is encountered during surgery, it may be mistaken for a metasta tic lesion. Then such patients may be de- nied a curative or palliative resection This is particularly true if the hemangioma is situated deep within the liver substance Biopsy during surgery should be made whenever an unidentified hepatic nodule or tumor is discovered

Benign adenomas of the liver are di vided according to their cellular origin hence such terms as benign hepatoma benign cholangioma and cholangiohepatoma are used Tumors showing more than one cellular element are sometimes referred to as hamartomas

The symptoms of benign tumors are usu ally mild or entirely absent Dyspepsia, epigastric distress distention and anorexia are common complaints In over half of the cases the patient discovers the mass Spon taneous rupture of such a lesion causes dramatic symptoms resembling an acute abdominal emergency Auscultation over a benign hemangioma may reveal a bruit Needle biopsy and peritoneoscopy are men tioned only to be condemned The reason for this dogmatic stand is that the author considers these procedures a 'peep show laparotomy Both of these adjuncts, par

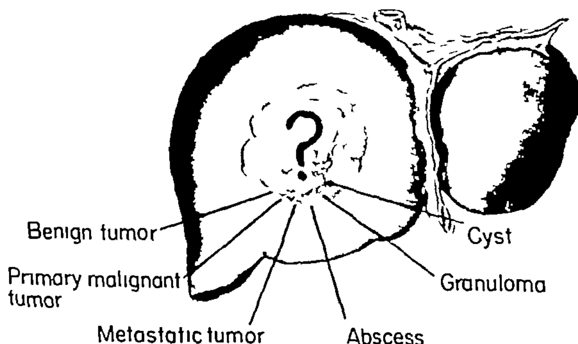


FIG 176 Laporotomy is necessary to confirm a diagnosis of a liver mass in the majority of cases.

ticularly needle biopsy predispose the patient to the danger of hemorrhage further more, parasitic cysts are difficult to differentiate from tumor masses, and one surely would not wish to spread such cystic disease throughout the peritoneal cavity Roentgenographic examination may reveal displacement of the stomach, the lower esophagus, or the colon depending upon the size and the location of the mass Laboratory data are essentially noncontributory

The author believes that the patient who presents an abdominal mass warrants a surgical exploration after a thorough study of the case It is extremely difficult and in most instances impossible to differentiate a benign tumor a malignant tumor a metastatic tumor a cyst, an abscess or a specific granuloma (Fig 176)

PRIMARY CARCINOMA OF THE LIVER

Incidence

Although infrequent in this country this condition is often encountered among the natives of South Africa and the Orient. The predilection for certain geographic areas and racial groups is one of its most unusual features The incidence in the American Negro is not nearly as high as that reported in African natives The American Negro is a descendant of Africa but it is the South African natives who show the highest incidence Malignancies in general are less common in the colored race but primary carcinoma of the liver seems to be the exception to this rule

The condition occurs most commonly in the so-called cancer age" between 50 and 60 but cases do appear in the extremes of life having been reported in the eighth decade and in an infant on the third day of life Well over half of the adult cases are associated with a pre-existing cirrhosis What these two conditions have in common if anything is unknown Methionine one of the sulfur-containing amino acids which is being used currently in the treatment of cirrhosis of the liver, seems to accelerate the development of these tumors in experimental animals Therefore, some research workers suggest that such amino acids which are necessary for normal growth are also necessary for growth of these neoplasms

Carcinomas of the liver may arise from the parenchymal epithelium or the epithelial lining of bile ducts on this basis they have been designated as malignant hepatomas or cholangiomas This distinction is of little clinical value and can be made only microscopically

Clinical Features

Since the symptoms are not specific, they are not diagnostic. The condition may present itself in 1 of 5 ways

1 The symptomatology suggests cirrhosis of the liver

2 This group projects disorders involving the biliary tract

3 The symptoms involve the gastro-intestinal tract and at times are associated with internal hemorrhage

4 This group is asymptomatic the condition is discovered accidentally during the patient s lifetime.

5 This group includes those cases which are discovered at necropsy

Pain is present in the majority of cases it is rarely severe or cramplike as when a hollow viscus is involved It is usually situated in the right upper abdominal quadrant or epigastrium The pain is due to enlargement of the organ which stretches Glisson s capsule When the onset is severe and abrupt, with signs of peritonitis, peforation of a necrotizing tumor should be suspected

Dyspepsia of varying degrees is present nausea and vomiting are rare *Hemorrhage* may manifest itself either as a bleeding esophageal varix, epistaxis or a bloody ascites *Cachexia* and *asthenia* are present in over half of the cases *Hepatic enlargement* depends upon the location of the tumor

Malignancy should be suspected whenever a patient known to have cirrhosis suddenly presents a rapidly enlarging solitary liver nodule *If the mass is in the dome of the right lobe* that side of the diaphragm may be elevated Such masses on the left side have been mistaken for an enlarged spleen *Ascites* if present is due either to a pre existing cirrhosis thrombosis of the portal vein, or involvement of the visceral and parietal peritoneum *Dependent edema* is due to hypoproteinemia or pressure on the inferior vena cava *Jaundice* is a late sign The *spleen* is palpable in about one fourth of the cases, but it is difficult to detect splenomegaly because of ascites, distention or hepatomegaly The splenic enlargement is secondary to a pre-existing cirrhosis or to portal vein involvement by tumor tissue

Diagnosis

Laboratory tests are of little value since marked impairment of liver function can be demonstrated only when the tumor is a large one.

Roentgenographic examination is helpful in that it may demonstrate esophageal varices (Fig 175) the size of the spleen and the liver the presence of a mass in the region of the liver and evidence of metastases Displacement of the diaphragm, or gastric air bubble gives contributory evi dence

Surgical Exploration Any or all of these cases that can withstand surgical in tervention should have the value of explora tion and possible alleviation of symptoms The metastases of this tumor are remark able in that they infrequently produce wide spread or distant lesions Although it has been shown that this primary tumor invades the hepatic and the portal veins relatively early the infrequency of distant metastases is most surprising This is particularly true of hepatoma The most common sites of metastases when they occur are the lungs the lymph nodes and the mediastinum If the skeleton is involved the vertebral column is the site of predilection

SARCOMA

Sarcoma of the liver is rare It appears to be associated with a pre-existing cirrhosis Hepatic sarcoma usually pursues a rapidly fatal course death occurs within a few months after the onset of this neoplasm This lesion is prone to disseminate widely throughout the liver and *to metastasize* via both the blood and the lymph channels The clinical course is essentially similar to that of carcinoma

METASTATIC TUMORS OF THE LIVER

Although the liver is a rare site for pri mary growths it ranks second only to re gional lymph nodes as a site for metastatic carcinoma The abdominal organs particu larly the stomach and the colon, should be investigated carefully as a possible primary site for these metastases The primary le sion can be symptomless and small and the metastatic lesions attract attention first The metastases gain access to the liver via the portal vein arterial emboli the lymph stream or by direct extension It has been stated that metastatic carcinoma of the liver carries an exceedingly poor prognosis since 85 per cent of the patients die within a year of their discovery One never should be too certain since remarkable cases do exist A case of metastatic carcinoma of the liver is recalled where the patient is surviv ing 26 years after discovery of the condi tion

Sarcomas of intra abdominal organs are more rare than carcinomas and when they do occur they rarely metastasize to the liver

SUBPHRENIC ABSCESS (SUBDIAPHRAGMATIC ABSCESS)

Divisions

The subphrenic area should be divided into 6 subphrenic spaces (Fig 177) Three of these are suprahepatic, and 3 are infra hepatic. This is important clinically because

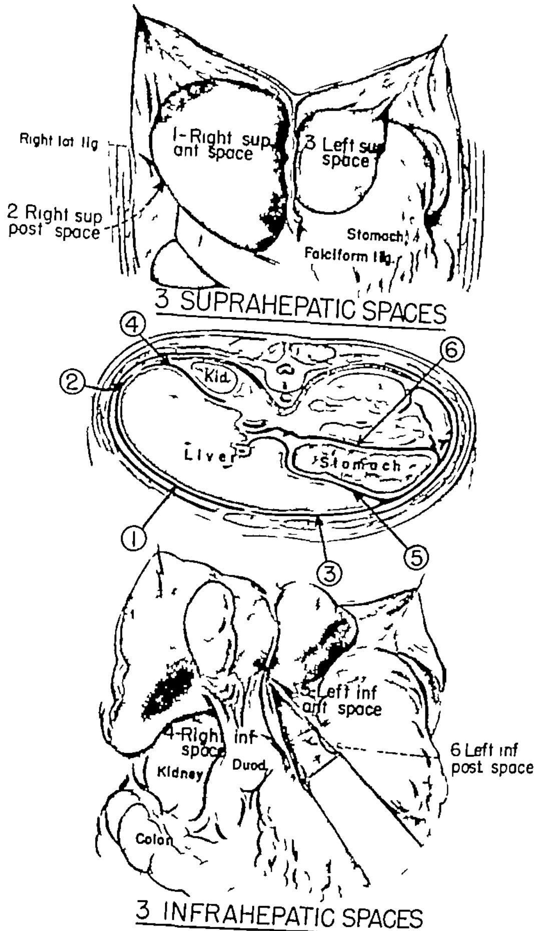


FIG 177 The 6 subphrenic spaces. The signs and symptoms of subphrenic abscesses depend upon which of these spaces are involved.

the signs and symptoms are altered according to the location These spaces are

1 Right superior anterior space
2 Right superior posterior space
3 Left superior space
4 Right inferior space (Morison's pouch)
5 Left inferior anterior space (perigastric space)
6 Left inferior posterior space (retrogastric space)

Etiology

The majority of such abscesses are associated with perforated gastroduodenal ulcers acute appendicitis or a diseased gall bladder Because of this the right superior posterior space is the one that is involved most frequently (Fig 178) Occasionally, these spaces may be infected from extension of an adjacent abscess (perinephric abscess) another mode of extension is from distant foci of infection

Clinical Course and Diagnosis

The diagnosis is difficult at times because of a lack of localizing signs or symptoms A *septic syndrome* is usually present this consists of intermittent spiking fever rigors profuse sweating and leukocytosis (over 20,000) Such a syndrome signifies pus *Pain* is often absent if present it appears as a dull vague deep ache in the right upper abdominal quadrant or the back Shoulder pain is suggestive of diaphragmatic irritation Physical signs are usually wanting but may be associated with a slight amount of fluid in the pleural cavity The author has not been able to elicit the so-

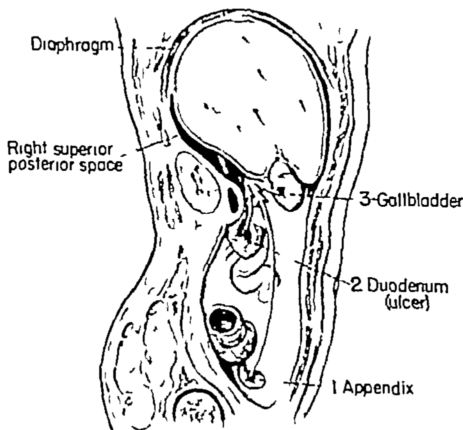


Fig. 178 The right superior posterior subphrenic space is involved most frequently because the 3 most commonly affected abdominal organs (appendix gallbladder and gastroduodenal segment) have access to it

called 3 layer percussion notes even in large abscesses If the abscess is in one of the anterior spaces tenderness usually is found at the costal border if posterior there may be tenderness over the twelfth rib on the involved side.

If untreated resolution is rare the abscess may rupture into the lungs the pericardium, the stomach the colon or through the parietes Pleural or pulmonary suppuration is a common complication.

Diagnosis

Fluoroscopy is a most valuable diagnostic aid. If a subphrenic abscess is present the hemidiaphragm on the involved side is either partially or totally immobile. If the abscess is large, the roentgenogram is helpful in that it reveals a high diaphragm the abscess may be demonstrated if it contains gas and a fluid level.

The use of aspiration or punctures as diagnostic aids are to be condemned because of the ease with which these abscesses are missed, and the danger of spreading the infection to the pleural and/or peritoneal cavities.

The differential diagnosis chiefly involves pleural empyema and liver abscess

Prognosis

The prognosis is guarded particularly if the diagnosis is made late and the patient is in poor condition The mortality can be lowered precipitously if early and adequate drainage is instituted

GALLBLADDER AND BILE DUCTS

The gallbladder is an important organ which has numerous key functions to perform. Its removal is strictly contraindicated unless a definite indication is present. The clinical results following cholecystectomy are directly proportional to the amount of disease present in the organ.

Some of the more important *functions of the gallbladder* include

1 Absorption The gallbladder concentrates liver bile approximately 10 times

2 Secretion An important mucoid material is secreted by its mucous membrane

3 Motor activity Bile is delivered to the duodenum at the proper time and rate

4 Change of pH of bile

5 Equalization of pressure within the entire biliary duct system

6 A reservoir for bile

7 Hormonal function (?)

Acute Cholecystitis

Incidence. The exact incidence of this condition is unknown because many such patients fail to consult a physician. The gallbladder type is the seven "F" type *Fair, Fat, Fertile Flabby, Flatulent, Female of Forty* (Fig 179)

Etiology Consensus points to an etiology that is primarily chemical the role of bacteria is secondary Stasis is the most important factor in the etiology of acute cholecystitis Hypercholesterolemia and pregnancy seem to be associated with the formation of gallstones Such stones obstruct the ducts and produce stasis and inflammation. It is true that there is a stoneless cholecystitis but stasis can be produced by other factors such as spasm, swelling kinks anomalous vessels and bands

When an excess of cholesterol is deposited on the mucosa of the gallbladder the appearance is not unlike the seeds on a ripe strawberry Because of this the term "strawberry gallbladder has been applied This is a cholesterolosis it does not produce clinical signs or symptoms and does not require cholecystectomy

The *organisms* encountered are usually those which normally inhabit the intestinal tract, namely streptococci and colon bacilli.

Pathology The appearance of th acutely inflamed organ d by the presence or the absen ting disease Frank pus (emp ly encountered even in an med gallbladder Ulceration l to

calculi Flimsy fibrinous or firm fibrous adhesions attach the gallbladder to the adjacent duodenum colon and/or stomach If the disease progresses gangrene and perforation result with subsequent bile peritonitis.

Symptoms *Pain* is the most prominent symptom Its onset is usually sudden and often follows the ingestion of a heavy or fatty meal The pain may be one of two types continuous if inflammatory or colicky if associated with obstruction It is important to differentiate these types of pain because an inflammatory lesion may be treated conservatively but an obstructed gallbladder demands immediate surgical relief The pain is located most often in the right upper abdominal quadrant but may be in the epigastrium It can be referred along its nervous path (splanchnic nerves) hence gastrospasms may confuse the picture If such a spasm is in the region of the gastric cardia the condition may be confused with coronary disease Gallbladder pain usually radiates to the tip of the right scapula or the interscapular area This must

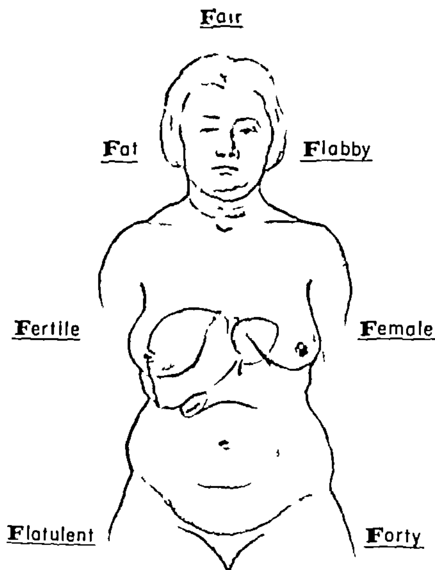


FIG 179 The gallbladder patient usually corresponds to the 7 'F type.

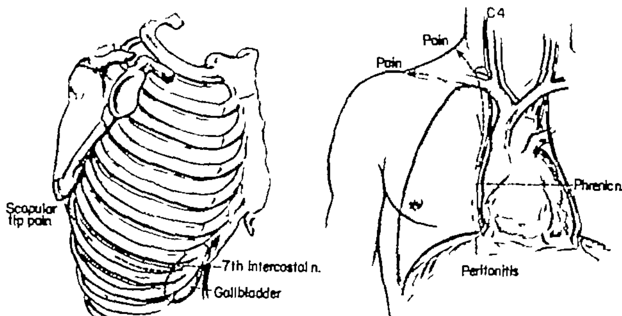


FIG 180 Gallbladder pain or peritonitis? Gallbladder pain radiates to the tip of the right scapula The pain of peritonitis radiates to the shoulder (phrenic nerve)

not be confused with shoulder pain which signifies irritation of the phrenic nerve and frequently is associated with peritonitis (Fig 180)

Nausea and *vomiting* are extremely variable and of little or no diagnostic value The presence of bile in the emesis merely denotes a patent pylorus

The temperature may be somewhat elevated however many cases of acute cholecystitis are afebrile It is important to emphasize that there is frequently little or no correlation between fever pain and the severity of the disease.

Cardiac irregularities and gallbladder disease are thought to be associated In acute cholecystitis, as in other inflammatory conditions the pulse increases 10 beats for every degree rise in temperature

Jaundice may accompany acute cholecystitis If this is present one must differentiate an associated hepatitis or obstruction of the common and/or hepatic ducts (*See* Jaundice p 194)

Tenderness when present in the right upper quadrant is a most important finding If the gallbladder is distended and displaced downward it may be palpable particularly if the patient is thin This habitus is infrequent in gallbladder patients After 36 or 48 hours an inflammatory mass (omentum wrapped around the gallbladder) may become palpable If the gallbladder is large and distended its fundus may reach to or below the umbilicus If the liver is ptotic, the gallbladder also may assume a low position.

Diagnosis. Such low lying inflamed gall bladders make differentiation from acute appendicitis difficult Helpful in the latter differential diagnosis is the demonstration of triangular areas of hyperesthesia as related to the umbilicus (Fig 181)

Some *laboratory tests* may be helpful adjuncts. The white blood cell count is usually elevated if the leukocyte count is over 20 000 one may suspect a purulent cholecystitis or an empyema The flat roentgenogram is particularly useful in detecting stones.

Differential Diagnosis It is true that one may list numerous conditions that simulate

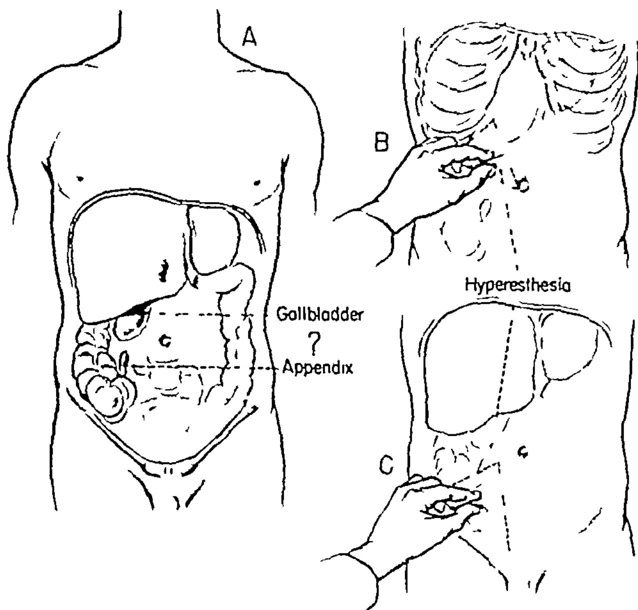


FIG 181 Appendix or gallbladder? If an inflamed appendix is retrocecal and high, or if an inflamed gallbladder is situated low and on a level with the umbilicus, it may be difficult to differentiate the two The detection of triangular zones of hyperesthesia as related to the umbilicus is of great help If the gallbladder is at fault the hyper esthetic triangular zone is directed upward from the umbilicus toward the right costal arch If the appendix is inflamed the zone is directed downward from the umbilicus toward the inguinal ligament

acute cholecystitis Such listings are merely a display of cerebral muscle The following 6 conditions constitute 95 per cent of the diseases that are confused with acute cholecystitis

1 Acute appendicitis (p 129)
2 Perforated peptic ulcer (pp 117 119)
3 Acute pancreatitis (p 212)
4 Renal and ureteral colics (p 251)
5 Acute salpingitis (pp 257, 258)

6 Coronary disease This last diagnosis must be suspected, particularly in males with a history of hypertension or a previous story of organic heart disease The typical picture offers no diagnostic difficulties whereas atypical coronary conditions can be

tragic if overlooked If an absolute differentiation between biliary and cardiac pain cannot be made the course of watchful expectancy is to be recommended

Chronic Cholecystitis

Incidence This condition is extremely common and at times difficult to diagnose It may be associated with or without gall stones and is frequently a sequel to acute cholecystitis The chronically inflamed gall bladder is thickened because of the deposition of scar tissue and at times calcium. Adhesions involve contiguous organs If the cystic duct becomes obstructed, a hydrops develops (p 202)

Symptoms. *"Dyspepsia"* is a common symptom It includes a multitude of complaints such as epigastric distress bloating, belching heartburn, mild pain distention, flatulence and anorexia. *Pain* is variable when present it frequently occurs in intermittent attacks It is usually localized to the right upper quadrant and may radiate to the tip of the right scapula or interscapular area. *Nausea* is frequent, and *vomiting* may occur during attacks. Certain foods are not tolerated well, particularly fried

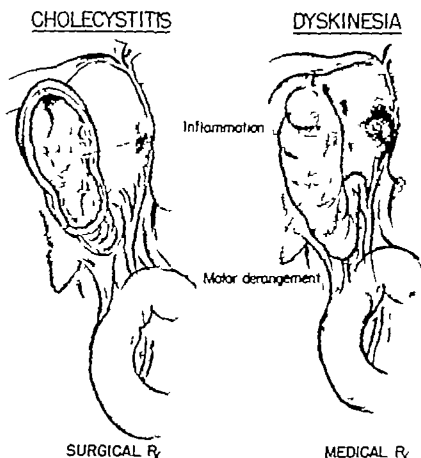


Fig. 182 Cholecystitis or biliary dyskinesia? Cholecystitis is the diseased gallbladder which results from inflammation and infection of the organ. It is associated with systemic signs and symptoms. It should be treated surgically The biliary dyskinesia is the functionally deranged gallbladder which is unassociated with fever, elevated white blood count and other signs and symptoms of inflammation. It responds well to medical treatment and therefore should *not* be removed.

and fatty foods, raw apples, cucumbers and cabbage. When these foods are eaten the patient complains of the two B's — bloating and belching. She further states that she feels more comfortable if she abstains from eating. This is in contrast with the peptic ulcer patient who takes food to obtain comfort. *Jaundice*, when present, usually is associated with hepatitis or a stone in the common or the hepatic duct (p. 201).

Diagnosis. *Physical examination* may reveal tenderness in the right upper quadrant; however, this is lacking unless an acute exacerbation is present. When the acute phase subsides the patient may be symptom free.

The roentgenographic study reveals a poorly or nonfunctioning gallbladder.

Differential Diagnosis. Numerous conditions may present the complaint of dyspepsia; however, 3 outstanding diseases must be differentiated. They are peptic ulcer (p. 115), coronary disease (p. 76) and esophageal hiatus hernia (p. 80).

BILIARY DYSKINESIA (DYSSYNERGIA)

These terms refer to a motor dysfunction of the gallbladder. The etiology is unknown and there is no discernible lesion. It is believed to be due to a neuromuscular derangement.

The symptoms suggest organic gallbladder disease (cholecystitis). Pain in the right



FIG. 183. Roentgenogram of a calcified gallbladder. No contrast medium has been given.

upper quadrant of the abdomen which radiates to the tip of the right scapula is present, and selective dyspepsia is complained of However the roentgenographic report reveals a well-concentrating and functioning gallbladder At times delayed filling and emptying of the viscus may be reported

These patients respond exceedingly well to diets that are high in fats Likewise they are relieved by nitrites other antispasmodics and mild sedative therapy

The patient with cholecystitis should submit to surgical therapy but the patient with dyskinesia should avoid surgery at all costs since she can be relieved by a proper medical and dietary regimen (Fig 182)

Calcification of the Gallbladder

This organ when inflamed is a common site for the deposition of calcium (Fig 183) The calcium may be precipitated onto the surface of gallstones or might lie free in the lumen of the viscus as a paste Roentgenograms may be interpreted erroneously as concentrated dye within the organ Unless the condition is kept in mind the stony hardness can give rise to an erroneous diagnosis of carcinoma.

Tumors of the Gallbladder

Carcinoma of the gallbladder is not uncommon since it represents about 5 per cent of all carcinomas It is 4 times more common in women. Calculi are present in almost every case of primary carcinoma of this organ. The signs and symptoms are those of chronic or acute cholecystitis and the presence of a typical mass This mass is located in the right upper quadrant, it is hard moves with respiration and is *irregular* (p 203) Jaundice may or may not be present depending upon the location of metastases or extension by contiguity Definite diagnosis is made during surgery

The gallbladder may be involved by direct extension or metastases from primary carcinomas elsewhere

Primary sarcoma of the gallbladder is a rare disease, when present it usually is associated with long standing cholecystitis and cholelithiasis

Choledochitis

Inflammation of the common bile duct has not received the attention that it deserves It may be associated with infection of the intrahepatic biliary radicals or may occur in conjunction with acute cholecystitis It is usually a complication of a stone impacted in the common duct. Cases are reported in which marked inflammation of this duct is present without choledocholithiasis It is impossible to diagnose this condition preoperatively It is characterized by edema hyperemia and at times suppurative inflammatory changes in the duct which may extend upward into the liver Removal of the obstruction, if present and adequate drainage of the duct are mandatory if the patient s life is to be saved.

Congenital Biliary Obstruction

When jaundice is due to a malformation of the biliary tract it appears shortly after birth progresses relentlessly and intensifies with each passing day When other causes of jaundice have been excluded (p 195) exploration should be carried out preferably before the fourth week of life

Carcinoma of the Extrahepatic Bile Ducts

This has been discussed elsewhere (p 203)

Postcholecystectomy Syndrome

This term is misleading since one does not know to what it refers The letter S" which has been used in Figure 184 enumerates some of the conditions that cause symptoms following the removal of the gallbladder

JAUNDICE

To understand the subject of jaundice one must comprehend the physiopathology of the bile pigments

PHYSIOLOGY

A review of the life cycle of a normal red blood corpuscle is a logical beginning The older erythrocytes are destroyed in the spleen (Fig 185) As a result of this an iron free part of hemoglobin called *hematoidin* is liberated Hematoidin is the precursor or mother substance of the main bile pigment *bilirubin* The reticuloendothelial cells throughout the body convert hematoidin to bilirubin This bilirubin is attached to a heavy protein molecule and is designated as bilirubin proteinate in this form it is delivered to the liver The liver removes the proteinate from the bilirubin and excretes the bilirubin in its pure state delivering it to the gallbladder via the bile duct system In the intestinal tract bilirubin is acted upon by bacteria which convert bilirubin to its end metabolite urobilinogen Some urobilinogen passes out and colors the feces and the remainder is absorbed from the intestinal tract and returned to the liver via the portal system The liver converts urobilinogen back to bilirubin Based upon this a most useful way of classifying the symptom of jaundice is

1 Prehepatic jaundice
2 Intrahepatic jaundice
3 Posthepatic jaundice

With this classification the clinician automatically asks himself Is the lesion *before* the liver, *in* the liver or *after* the liver?

PREHEPATIC JAUNDICE (FIG 186)

Conditions producing this type of icterus are associated with an increased destruction of red blood cells (icterus neonatorum) increased fragility of these cells (hemolytic anemia) or those conditions in which the

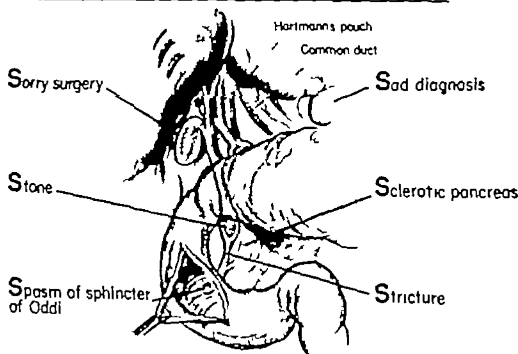


FIG. 184 The term "postcholecystectomy syndrome" is a misleading one and should not be used The causes of symptoms following cholecystectomy have been enumerated with the "S mnemonic Sorry surgery refers to an operation that is incomplete or unnecessary Sad diagnosis implies a diagnostic error Particularly in this latter instance must be mentioned an over looked hiatus hernia

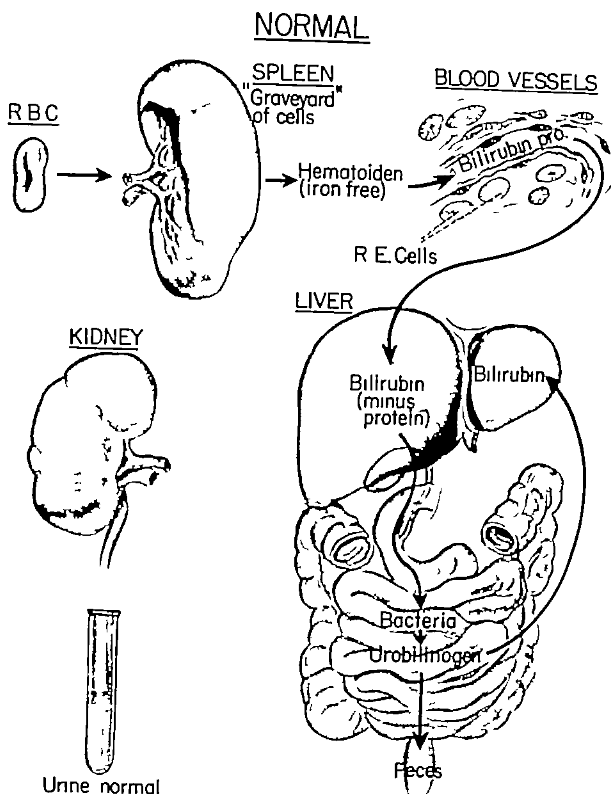


Fig 185 The normal metabolism of bilirubin and urobilinogen. If there is no excess of these metabolites, they do not overflow into the blood stream and the urine and therefore do not appear in abnormal amounts.

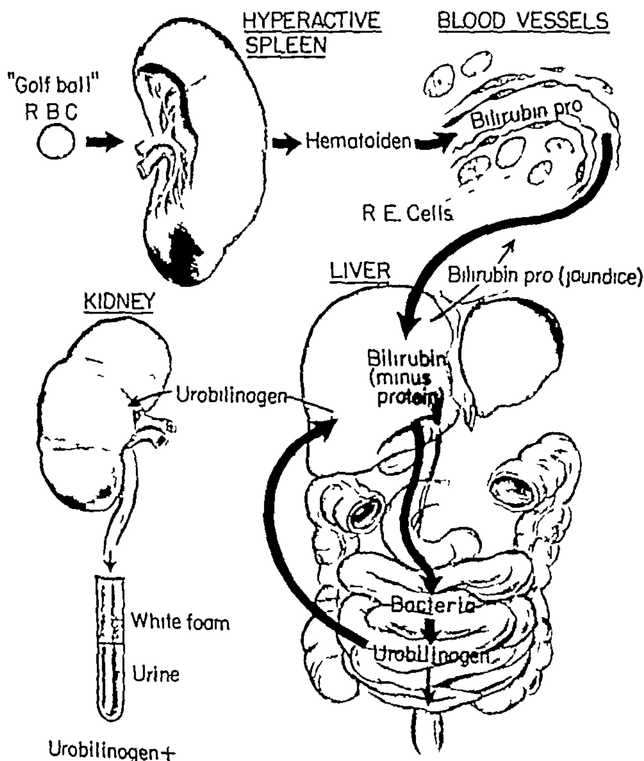


Fig 186 Prehepatic jaundice The heavy arrows denote excessive production of the bile pigments. The light arrows denote overflow of these substances.

	PREHEPATIC	INTRAHEPATIC	POSTHEPATIC
URINE	White foam	Yellow foam	Yellow foam
FUNCTION TESTS	0	4+	0
JAUNDICE			
PRURITUS	0	+ or −	4+

FIG 187 Diagrammatic presentation of the differential diagnosis of the 3 types of jaundice. As a rule the degree of jaundice is mild in the prehepatic type moderate in the intrahepatic type, and marked in the posthepatic type The latter 2 types may overlap

spleen is overactive and destroys the cells (hypersplenism) The physiopathology in all of these conditions is essentially the same namely excessive destruction of erythrocytes this results in an overproduction of hematoidin the mother substance of bile It follows therefore that an excessive amount of bilirubin proteinate will be produced and delivered to the liver The liver although normal cannot excrete this excess and it overflows into the blood stream The jaundice which results is caused by bilirubin proteinate a substance that is too heavy to filter over the renal threshold hence there is no bile pigment in the urine This produces an acholuric jaundice in other words this jaundiced patient has no bilirubin in his urine This is diagnosed readily if one examines the urine in a test tube it is light and the urinary foam is white The liver function tests (p 175) are negative since there is no dam-

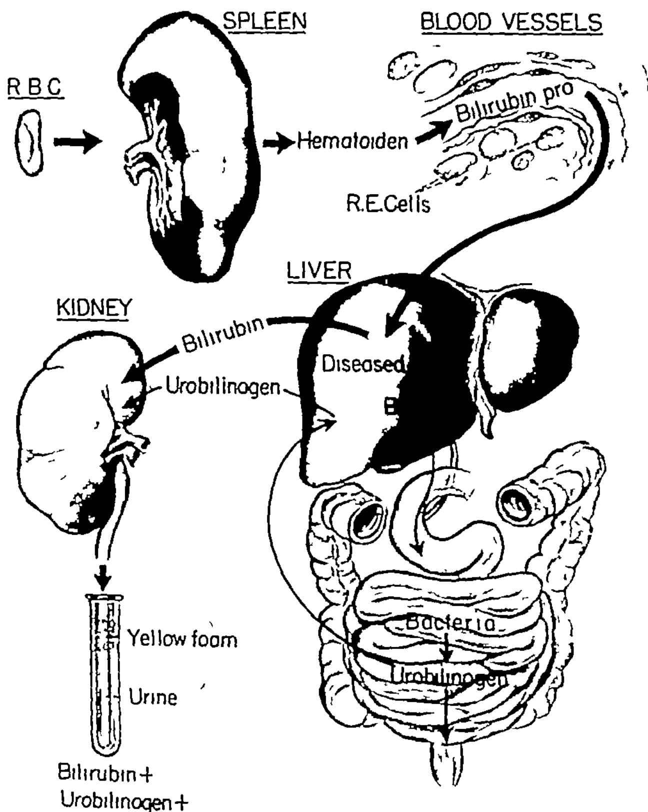


FIG 188 Intrahepatic jaundice In this instance the lesion is in the liver The heavy arrows indicate excess and the light arrows indicate overflow of the pigments. Note that the urine contains both bilirubin and urobilinogen

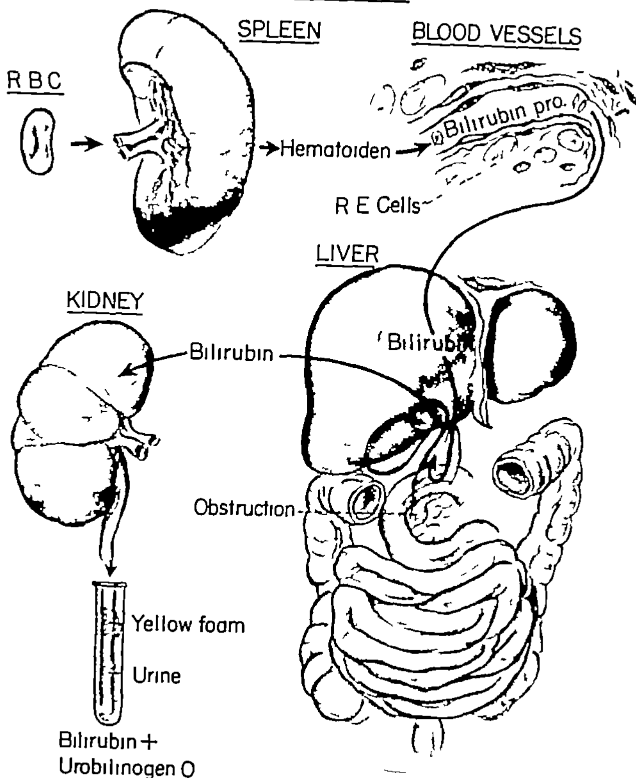


FIG. 189 Posthepatic jaundice. The lesion is usually in the common duct, the ampulla of Vater or the head of the pancreas. The urine contains bilirubin but no urobilinogen

age to the liver This is a light type of jaundice and may be overlooked In summary, then it may be stated that a patient with a prehepatic jaundice presents a light type of icterus a light urine with a white foam, and negative liver function tests (Fig 187)

Intrahepatic Jaundice (Fig 188)

In this type of jaundice, the lesion is *in* the liver, this also has been referred to as parenchymatous jaundice It must be assumed that the entire liver has not collapsed if the patient is still alive the amount of damage in given cases varies Many toxins and/or organisms can injure this organ and interfere with one or more of its many functions hence the liver function tests should indicate such damage

Liver function tests are legion If one were to attempt to do all of these he would deplete his patient of time, energy and money The author has found the following tests to be most helpful

1 Ehrlich s aldehyde test for urobilinogen
2 The cephalin flocculation test (Hanger)
3 The thymol turbidity test
4 The albumin-globulin ratio

The qualitative aldehyde test for urinary urobilinogen is quickest and least expensive and also is accurate It can be done at the bedside by adding 1 cc of Ehrlich's aldehyde reagent which is yellow in color, to 5 cc. of *freshly* voided urine If a pink or red color appears one has reason to suspect a diseased liver that is unable to convert urobilinogen back to bilirubin Other liver function tests should then be done plus a quantitative urobilinogen test Various authors have their favorite battery of tests The clinician should take a *few* of these in which he has most faith and let this constitute the liver profile"

In summary, then one can state that in intrahepatic jaundice the skin discoloration is deeper the urine is dark and its foam is yellow (bilirubin) the liver function tests are positive (Fig 187)

Posthepatic Jaundice (Fig 189)

In this type, the lesion is distal to the liver (as bile flows) This has also been referred to as obstructive jaundice Examples should include stones in the common and the hepatic bile ducts tumors of the common and the hepatic ducts tumors of the head of the pancreas, and metastases to the porta hepatis

In such cases the icterus is much deeper, varying from brown to bronze or even black yellow The obstruction to the flow of bile can be either partial or complete *Stones may have a ball valve action and* tumors may ulcerate, hence, the degree of jaundice may vary from time to time If the obstruction *is complete* no bilirubin will enter the duodenum and no urobilinogen will be formed the aldehyde test will be negative If the obstruction is *incomplete* that bilirubin which enters the duodenum is converted to urobilinogen which is returned to the liver and converted back to bilirubin as long as the liver is normal. Those patients who have been jaundiced by an obstructing lesion for 4 to 6 weeks develop a biliary cirrhosis These patients originally have a posthepatic jaundice but later develop the intrahepatic type and the liver function tests become positive This should not cause confusion if a careful history is elicited

In summary one can state that in post hepatic jaundice the jaundice is deep in color the urine is very dark (Coca-Cola) the urinary foam is yellow (bilirubin) and the liver function tests are negative (Fig 187)

Diagnosis

Courvoisier's law (Fig 190) states that in the presence of a large gallbladder unassociated with jaundice a cystic duct obstruction must be suspected (mucocele or hydrops of the gallbladder) a small gall bladder in the presence of jaundice usually

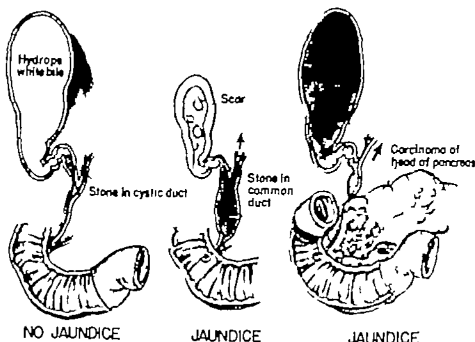
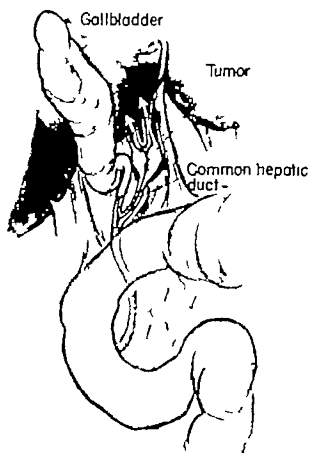


FIG 190 Courvoisier's law When a stone is in the cystic duct the gallbladder is distended and large but no jaundice is present when a stone is in the common duct the scarred gallbladder is shrunken and small and jaundice is present with a carcinoma of the head of the pancreas, the gallbladder is distended and jaundice is present.



indicates a stone in the common bile duct and a large gallbladder in the presence of jaundice indicates a malignancy (head of the pancreas or common duct) To this must be added the possibility of a carcinoma of the common hepatic duct with complete obstruction (Fig 191) In the latter instance jaundice is present but since no bile reaches the gallbladder this organ is small shrunken and practically empty except for some mucoid material

When the cystic duct is obstructed bile cannot enter the gallbladder nor can the mucoid material which originates in the gallbladder escape For this reason "white bile is present The word bile is in quotes because the contained material is truly not bile the bile pigment which was entrapped in the gallbladder is gradually absorbed

FIG 191 Carcinoma of the common hepatic duct. This is suspected when jaundice is present, plus a small empty noncicatrized gallbladder

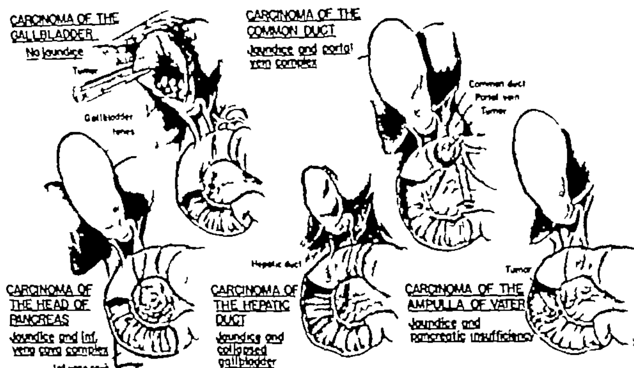


Fig 192 The differential diagnosis of carcinomas involving the biliary tract The 5 outstanding conditions are included in this illustration

Stones in the common bile duct produce repeated bouts of cholecystitis which result in scar tissue formation as a result of this the gallbladder is shrunken thick and small The gallbladder is large in the presence of a carcinoma of the head of the pancreas or the common duct because the organ is not inflamed and retains its elasticity the bile that cannot enter the duodenum is forced up into this noncicatrized organ

The differential diagnosis of carcinomas involving the biliary tract should include (Fig 192)

1 Carcinoma of the gallbladder
2 Carcinoma of the common bile duct
3 Carcinoma of the head of the pancreas
4 Carcinoma of the ampulla of Vater
5 Carcinoma of the common hepatic duct

In *carcinoma of the gallbladder* jaundice is not present at the onset because the mass usually is located in the region of the fundus and does not interrupt the flow of bile (Fig 193) It is rare to find a carcinoma of the gallbladder that does not con

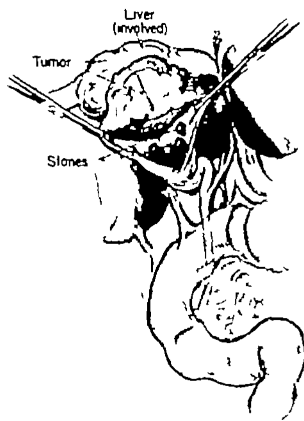


Fig 193 Carcinoma of the gallbladder usually involves the fundus and is almost always associated with gallstones. Jaundice is absent unless metastases cause obstruction to the outflow of bile

tain gallstones The malignant mass is characteristic in that it is located in the right upper quadrant, it is hard moves with respirations and is *nodular* The nodularity differentiates it from a hydrops of the gall bladder Metastases to the porta hepatis may produce jaundice but this appears late

Carcinoma of the common duct should be suspected when jaundice is associated with a portal vein complex (Fig 194) By portal vein complex is meant the clinical picture of portal hypertension this results from extension of the malignant growth to the portal vein One recalls the close anatomic relations of the portal vein and the common bile duct Portal hypertension produces ascites, splenomegaly and dilated veins (esophageal varices, hemorrhoids) An accurate history will reveal that the jaundice preceded the portal hypertension picture, whereas in cirrhosis of the liver the jaundice appears late and is mild

Carcinoma of the head of the pancreas has been discussed with Courvoisier's law (Fig 190) To this can be added the fact that since the pancreas is retroperitoneal, a sizable mass involving it not only obstructs the common bile duct but also can attack the inferior vena cava (Fig 192) An inferior vena cava complex is characterized by dependent pitting edema of the inferior extremities which is associated with dilated

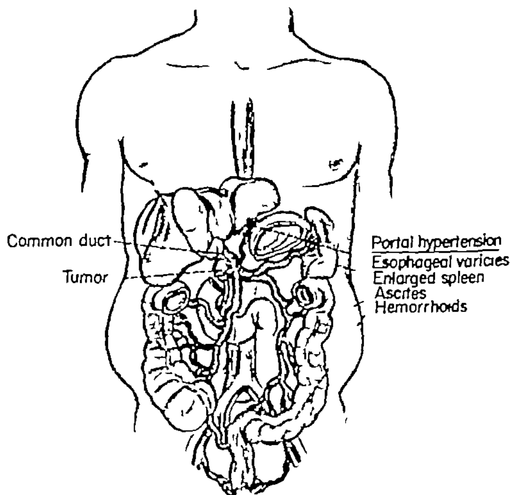


Fig 194 Carcinoma of the common bile duct is characterized by a jaundice and portal vein complex. The latter produces the signs and symptoms of portal hypertension.

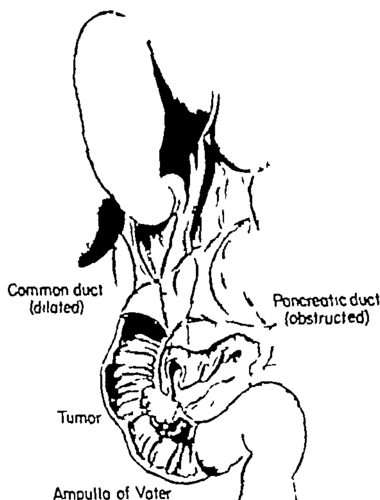
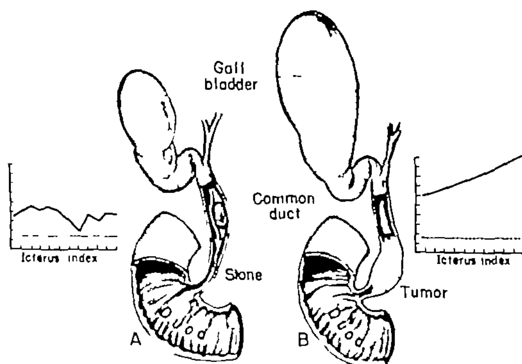


FIG 195 (*Left*) Carcinoma of the ampulla of Vater produces jaundice and a pancreatic insufficiency

FIG 196 (*Bottom*) A stone in the common duct or carcinoma? If jaundice is due to a stone in the common duct the gallbladder is small and thick and the serum bilirubin (icterus index) can fluctuate from day to day If the jaundice is due to a carcinoma involving the common duct the pancreas, or the ampulla of Vater the gallbladder is large and the serum bilirubin remains high or increases



superficial veins. Since this is unassociated with dyspnea or orthopnea, a cardiac dependent edema should not cause confusion

Carcinoma of the ampulla of Vater is suspected when jaundice is associated with pancreatic insufficiency (Fig 195) The latter results from an absence of pancreatic enzymes in the intestinal tract This can be detected if the patient is fed meat and the stool is examined 24 hours later It will be noticed that striated undigested meat fibers are present

Carcinoma of the common hepatic duct as stated, must be considered when a jaundice is present and the gallbladder is small and empty

The differentiation between a stone in the common duct and a carcinoma of the biliary tract usually can be made preoperatively It is true that in most instances painful jaundice is associated with a stone whereas the less painful progressive jaundice suggests a tumor However approximately 20 per cent of patients with stones in the common bile duct are not jaundiced. This is due to a ball-valve action of the stones A tumor usually produces complete biliary obstruction but such tumors may ulcerate and permit some bile to slip through This would produce a fluctuating type of jaundice and suggest a stone The author has found it helpful to check the serum bilirubin or icterus index for 5 consecutive days (Fig 196) If the readings continually rise or do not fluctuate this suggests a neoplasm whereas if there is fluctuation a stone is more probable Exploratory surgery may be necessary to arrive at a final diagnosis

Pruritus is a most helpful symptom in the differential diagnosis Pruritus is not a symptom of jaundice but is a symptom of posthepatic (obstructive) jaundice particularly if it is the patient's *primary* complaint The author never has heard of a case of prehepatic jaundice in which pruritus was present, occasionally parenchymatous (intrahepatic) jaundice may be

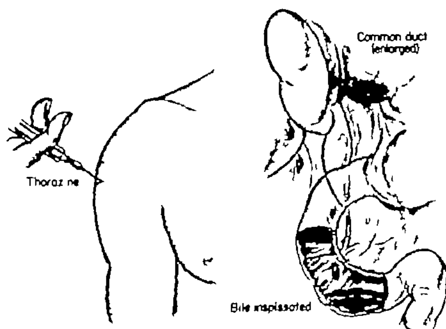


FIG 197 Jaundice due to Thorazine (chlorpromazine) This is a nonsurgical type of jaundice and the icterus disappears when the therapy is discontinued

associated with mild pruritus, but when the outstanding *complaint is pruritus this is* pathognomonic of a posthepatic or obstructive jaundice

The *pulse* is usually slow in cases of icterus Bradycardia is a welcome finding since a tachycardia in the presence of jaundice forebodes liver collapse

Recently cases of jaundice have been reported following the use of Thorazine (*chlorpromazine*) (*Fig 197*) The exact mechanism is unknown hence it is difficult to classify at this time It seems it is associated with some dilatation of the common duct and inspissated bile These are nonsurgical cases and apparently these patients recover when the medicament is discontinued

8

Pancreas

GENERAL CONSIDERATIONS AND PHYSIOLOGY

The pancreas is one of the smallest and most deeply placed organs in the abdominal cavity It lies transversely in the epigastrium, crossing the bodies of the 12th thoracic and 1st lumbar vertebrae It extends from the curve of the first part of the duodenum, to which it is firmly attached to the hilum of the spleen

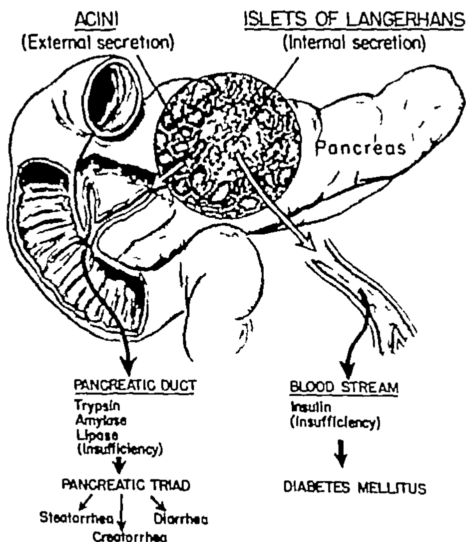


Fig 198 Physiology of the pancreas. Its internal secretion produces insulin its external secretion produces digestive enzymes (trypsin amylase and lipase)

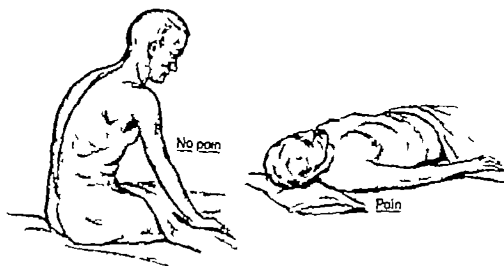


FIG 199 (*Top*) Pain of pancreatic origin is aggravated by the supine position but is relieved by sitting or the prone position.

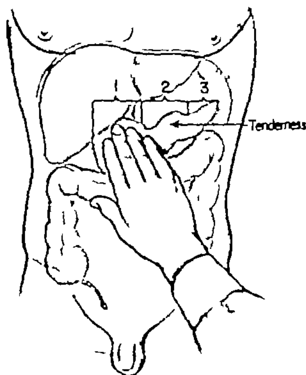


FIG 200 (*Right*) Pancreatic tenderness is located supra umbilically

Physiologically the pancreas plays a double role endocrine (carbohydrate metabolism) and secretory (digestive) (Fig 198)

The endocrine function is concerned with the production of insulin which is formed in the islets of Langerhans Deficiency or absence of this internal secretion produces diabetes mellitus The islets are diagnostically and surgically important because of the occurrence of adenomas which produce hypoglycemic syndromes (p 221)

The external secretion is produced by the alveolar tissue. This reaches the duodenum via the ductal system of the pancreas From 1,500 to 2,000 cc. is secreted in 24 hours. The main enzymes are trypsin, amylase and lipase. Deficiency of the external pancreatic secretion produces a typical *pancreatic triad* This consists of

1 Steatorrhea (bulky gray frothy stools due to excess fat)

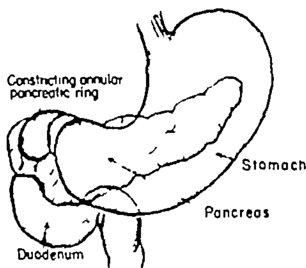


Fig 201 Annular pancreas.

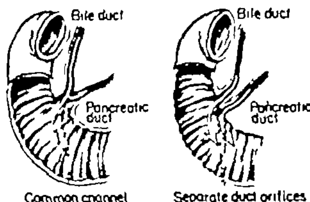


Fig 202 *Some individuals have a common channel for both the common bile and the pancreatic ducts. Such people supposedly are predisposed to pancreatitis because bile may regurgitate up into the pancreas*

2 Creatorrhea (excess of protein and undigested meat fibers in the stool)

3 Diarrhea (due to imperfect digestion and excessive fermentation)

Pancreatic pain is aggravated when the patient is on his back but is relieved when he is in a sitting or prone position This applies to both acute and chronic pancreatic conditions (Fig 199)

Tenderness may be situated anywhere along the involved viscus For this reason one cannot exactly pinpoint pancreatic tenderness but when present it is located supra umbilically (Fig 200)

CONGENITAL ABNORMALITIES

Pancreatic Heterotopia

Aberrant pancreatic tissue which has no connection with the main mass of pancreatic gland may occur at any site along the gastro-intestinal tract. The most common location however is around the pyloric end of the stomach and the duodenum The presence of such tissue has been recorded also in the jejunum and in Meckel s diverticulum Usually ectopic pancreatic tissue causes no symptoms but those that occur in the region of the stomach or the duodenum may produce *pain, hemorrhage* or obstruction and inflammatory changes When it occurs in the small intestines particularly in a Meckel s diverticulum it may act as a spearhead for an intussusception These are usually confused with tumors polyps and ulceration If found during abdominal explorations they should be excised

Annular Pancreas

This rare anomaly results from faulty embryologic development An annular pancreas completely encircles the second part of the duodenum at the level of the major duodenal papilla (Fig 201) The symptomatology depends upon the presence and the degree of duodenal obstruction This is characterized by colicky abdominal pain nausea and vomiting as seen with upper gastro-intestinal obstruction If the degree of obstruction is minimal the symptoms may be delayed until adult life *Peptic* ulceration of the first part of the duodenum may be a concomitant finding Roentgenograms reveal a smooth narrowing of the second portion of the duodenum. Duodenojejunostomy or gastrojejunostomy are curative

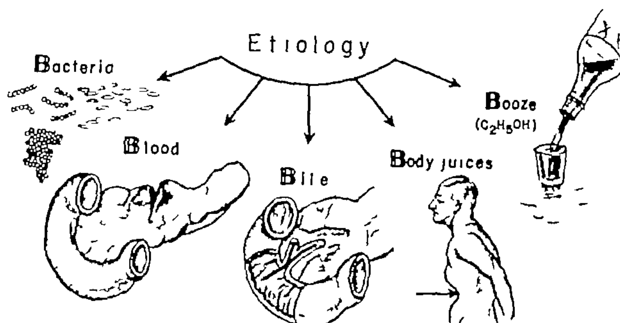


FIG 203 The etiology of acute pancreatitis

ACUTE PANCREATITIS

This condition has been divided into acute edematous and acute hemorrhagic pancreatitis It is important to diagnose acute pancreatitis per se whenever possible since the modern trend toward conservative management lowers both the morbidity and the mortality

ETIOLOGY

The etiology may be related to biliary tract disease and the possible presence of a common channel which exists between the terminal bile and the pancreatic ducts (Fig 202) Fitz in 1889 gave an accurate description of the condition Opie, in 1901 described a case of pancreatitis produced by a stone lodged in the ampulla of Vater, he proposed the common channel theory whereby bile regurgitates into the pancreas via the pancreatic duct. It is presupposed that bile salts activate pancreatic ferments which in turn digest the surrounding tissues This results in edema, necrosis and hemorrhage

Other factors have been associated with the etiology, namely trauma producing interstitial hemorrhage bacteria, and ingestion of food and alcohol. The author has devised a mnemonic aid showing that the causes of pancreatitis may be associated with the letter "B" *B*acteria, *B*lood, *B*ile, *B*ody Juices and *B*ooze (Fig 203)

SYMPTOMS

Pancreatitis may affect patients of any age but predominately those in the middle-age group Symptoms vary depending upon the extent of the disease with pancreatic edema the symptoms are mild and vague whereas in pancreatic necrosis they are violent. The *onset* is sudden and frequently follows the ingestion of a heavy meal and/or alcoholic beverages.

Pain originates in the epigastrium and is constant It increases to an agonizing severity and is rarely relieved by a single injection of morphine. It tends to radiate through to the back at a level which corresponds with the anterior location of the organ at times it radiates to the left loin These patients are relieved in a sitting posi

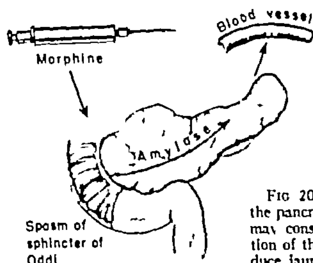


Fig 204 An edematous head of the pancreas in severe pancreatitis may constrict the pancreatic portion of the common duct and produce jaundice.

tion and are more distressed when lying on their backs

Nausea and vomiting appear shortly after the onset of pain Rarely does vomiting produce relief

Physical examination reveals an appearance which leaves no doubt as to the severity of the illness Whereas *shock* is absent in interstitial (edematous) pancreatitis it occurs in almost every case of the necrotizing type There is a striking contrast between the severity of the illness and the paucity of physical findings The *pulse* is weak and at times increased The *temperature* is normal in early cases *Tenderness* is almost always present and is located supra umbilically As the disease progresses, *abdominal distention* appears, and the *peristaltic sounds become diminished* Muscle spasm and rigidity are infrequent. *Jaundice* is present in about 25 per cent of the cases and is due to obstruction of the common duct by edema of the head of the pancreas (Fig 204) gallstones at the ampulla or associated hepatitis may also produce jaundice Cullen s sign (discoloration of the peri umbilical area) or Grey Turner s sign (discoloration in the flanks) are supposedly due to extravasation of blood into the retroperitoneal space These are extremely rare although it is recorded that they are present in 10 per cent of the cases

Laboratory Data

Leukocytosis is usually present to a moderate degree however, this is nonspecific. Hemoconcentration as characterized by a high hematocrit and hemoglobin values occur early in the course of the disease

The *serum amylase* content is almost always elevated early in the course of the disease A simple laboratory test devised by Somogyi is based upon the amylolytic action of blood serum on starch 180 Somogyi units are considered an upper limit of normal, and any figure over 200 is considered abnormal If the disease subsides or if the necrosis is so severe that no more ferments are produced the serum amylase drops abruptly For these reasons the determination must be made, preferably within the first 48 to 72 hours. Morphine will also give an elevated serum amylase test (Fig 205) It must be remembered, too that other conditions such as peritonitis pneumonia and perforated ulcers also may cause an elevated serum amylase test. Therefore this test is suggestive of pancreatitis but is not pathognomonic.

The *serum lipase test* also has been utilized. This remains elevated longer than the amylase value however the test requires additional time and equipment

Hyperglycemia, glycosuria and hypocalcemia also may be present

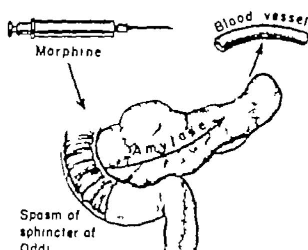


Fig 205 The serum amylase test may be elevated by injections of morphine This is supposed to be caused by the smooth muscle contracting effect of morphine on the sphincter of Oddi with resulting regurgitation of amylase into the blood stream.

The *roentgenologic findings* are not specific. A segmental ileus has been described It appears as "a sentinel loop" of jejunum

Differential Diagnosis

Numerous conditions producing acute abdominal pain could be included herein however only the more common ones will be mentioned

1 Acute cholecystitis (p 188)
2 Perforated peptic ulcer (pp 117, 119)
3 Small bowel obstruction (pp 161 170)
4 Acute appendicitis (p 129)
5 Mesenteric thrombosis (p 128)
6 Gallstone ileus (pp 171 172)
7 Coronary occlusion (p 128)

Complications

Acute pancreatitis should be treated conservatively however, its complications usually require surgical therapy The complications are cysts abscess, pancreatic lithiasis and chronic relapsing pancreatitis (Fig 206)

Prognosis

Patients with pancreatic edema usually recover but the mortality of acute hemorraghic pancreatitis still remains high Delayed surgery or adequate conservative treatment has lowered the mortality in this condition from 50 to 15 per cent.

CHRONIC RELAPSING PANCREATITIS

This condition is a recurrent one usually progressive, and associated with attacks of upper abdominal pain It has assumed con-

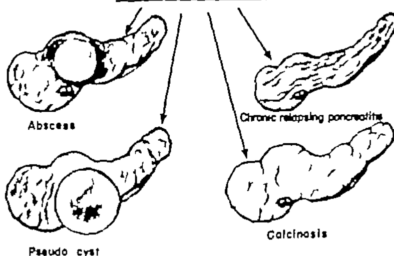
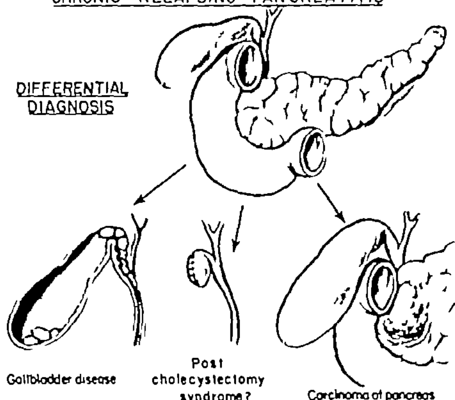


Fig 206 The complications of acute pancreatitis.

Fig. 207 The differential diagnosis of chronic relapsing pancreatitis.



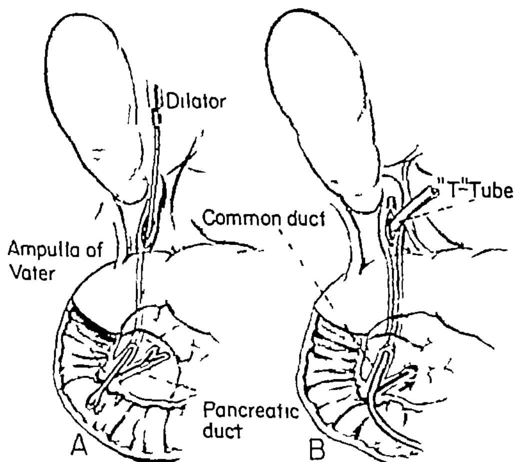


Fig 208 Dilators may tear the tissue around the ampulla of Vater and produce edema, stasis and inflammation (pancreatitis) Constant pressure by long "T" tubes can produce obstruction of the pancreatic duct with resultant inflammation of the pancreas.

siderable significance as it is frequently confused with and at times impossible to differentiate from carcinoma of the pancreas, cholecystitis or so-called postcholecystectomy syndrome (Fig 207)

Etiology

The etiology is undetermined but appears to be associated with acute pancreatitis The use of large sounds and dilators in the common duct produces trauma to and edema at the ampulla of Vater, which in turn results in stasis If a common pancreatobiliary channel is present, this trauma can produce stasis and inflammation in the pancreas (Fig 208 A) The author is of the opinion that long T tubes which pass through the common duct and into the duodenum may also produce stasis by constant pressure on or obstruction of the pancreatic duct which, in turn results in pancreatitis (Fig 208 B)

Symptoms

Abdominal *pain* precipitated by the ingestion of food is the usual symptom. Frequently it is referred to the back and is aggravated by assuming the supine position.

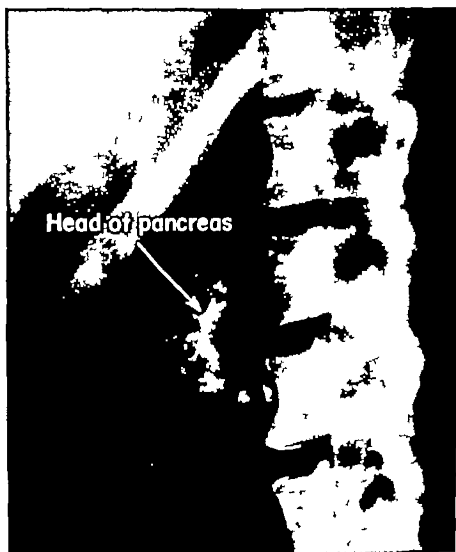


Fig 209 Roentgenogram revealing calcium deposition in the pancreas.

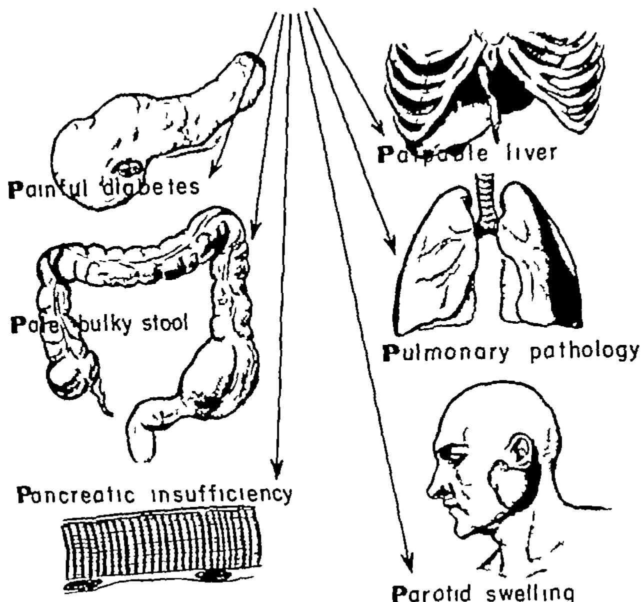


Fig 210 Some of the signs and symptoms which should suggest chronic relapsing pancreatitis. The letter "P" has been used as a mnemonic.

Diarrhea is present in about half of the cases The pain may be severe enough to require sedation *Jaundice* may be associated with an acute attack or appear as a painless progressive icterus suggesting a malignant neoplasm. The jaundice is a result of edema of the head of the pancreas which compresses the pancreatic portion of the common duct (Fig 204) In about one third of the cases the symptoms of diabetes are noted first

The physical examination is essentially noncontributory At times some tenderness is noted supra umbilically

Laboratory Data

Early in the course of the acute phase the serum amylase may be elevated Following the administration of secretin a diminished pancreatic excretion can be demonstrated by analysis of the duodenal contents Glu

cose tolerance alterations are demonstrable in about one third of the cases the presence of excess fat and undigested meat fibers in the stool are also suggestive

The flat roentgenogram may reveal calcium deposits within the parenchyma of the gland which result either from calcium depositions or pancreatic calculi (Fig 209) No correlation exists between the roentgenographic demonstration of such calcific deposits and the severity of the clinical picture

The letter "P has been used as a mnemonic to recall the symptoms and the findings which should suggest this elusive condition (Fig 210)

Chronic relapsing pancreatitis is one of the conditions which must be kept in mind constantly and included particularly in the differential diagnosis of peptic ulcer gall bladder disease hiatus hernia and coronary occlusion.

PANCREATIC CYSTS

Types

Cysts of the pancreas can be divided conveniently into 5 types (1) congenital (2) retention (3) neoplastic, (4) infections and (5) pseudocysts.

They have been divided surgically into true and pseudocysts in that the pseudocysts are not lined with epithelium, whereas the true cystic cavities are (Fig 211)

The most important type of pancreatic cyst clinically is the *pseudocyst* These are in reality encapsulated accumulations of fluid in and about the pancreas which occur as a result of trauma or inflammation A forceful blow or a severe crushing injury which involves the upper abdomen is frequently revealed in the history The pseudocyst results from the inflammatory destruction of a part of the pancreatic parenchyma into which there is an escape of pancreatic enzymes (Fig 212) The cystic fluid is clear or serosanguinous and contains bits of necrotic tissue.

Symptoms

Pain usually is associated with cysts that have attained considerable size The pain is in the upper abdomen and radiates to the region of the costal arch or the back Systemic symptoms include weight loss, fatigue, nausea, vomiting and anorexia. The cyst may be palpated more often toward the left subcostal area as a firm tense tumor in the epigastrium Tenderness is more common in the pseudocyst than in retention or neoplastic cysts. Extrinsic pressure is exerted

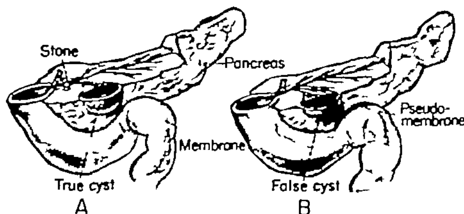


FIG 211 Pancreatic cysts. The true cyst is rare, is associated with obstruction (retention) and has a well-defined capsule (epithelium) The pseudocyst is common is associated with trauma or inflammation and has a false capsule (fibrous)

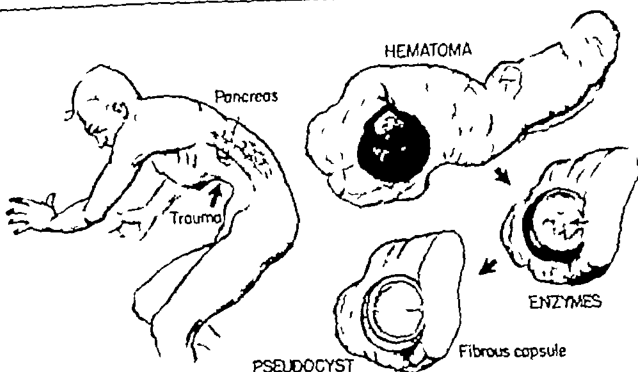


Fig 212 The physiopathology of a pseudocyst of the pancreas.

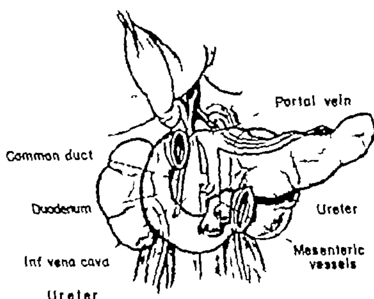


Fig 213 Some of the structures upon which pancreatic cysts may exert pressure

upon contiguous structures (Fig 213) Many of these cysts arise in the retroperitoneal space and project forward into the lesser peritoneal cavity others are intraperitoneal resulting from a rupture of the pancreatic capsule They may point through the gastrohepatic or the gastrocolic omenta or may be insinuated between the layers of the transverse mesocolon.

Laboratory Data

Specific laboratory tests are available Elevated serum and urinary diastase and fasting blood sugars occur more frequently in cysts of inflammatory or neoplastic origin The *flat roentgenogram* of the abdomen usually reveals a spherical mass in the upper abdomen Extrinsic pressure

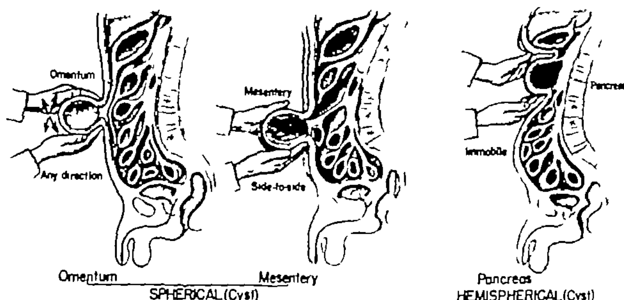


FIG. 214 An omental cyst can be moved in any direction a mesenteric cyst can be moved from side to side and a pancreatic cyst is immobile. The former two are spherical the latter is hemispherical.

upon the stomach the duodenum the small bowel and the colon may be demonstrable with routine roentgenologic study Similar displacements may be noted by barium enema or intravenous pyelograms

DIFFERENTIAL DIAGNOSIS

Pancreatic cysts must be differentiated from retroperitoneal tumors mesenteric cysts omental cysts hepatic cysts and renal or perirenal masses *Splenic cysts* are

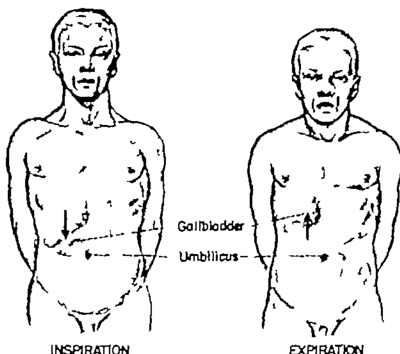


FIG 215 Differential diagnosis of enlarged gallbladder or pancreas The gallbladder possesses a greater range of movement with respiration

difficult to distinguish from those involving the tail of the pancreas *Cysts of the omentum and the mesentery* are suspected by their extreme mobility Those originating in the greater omentum may be moved in all directions Cysts or tumors of the mesentery are more mobile in a transverse plane Omental and mesenterial cysts tend to be spherical but the palpable portion of a pancreatic cyst (the exception being the tail of the organ) is hemispherical (Fig 214) The mobility of pancreatic cysts depends upon other locations and the degree of surrounding inflammatory reaction Cysts located in the pancreatic head or body are essentially immobile although they may descend slightly on inspiration those cysts that involve the tail are less fixed this latter range of mobility might be confusing

A distended gallbladder may be mistaken for a cyst of the pancreas however, the gallbladder moves with respirations (Fig 215)

Congenital cysts are characterized by atresia of the pancreatic ducts with the formation of numerous minute cysts A rare condition known as Lindau's disease is the association of renal hepatic and pancreatic cysts with angiomas of the brain (retina) subnormal mentality completes the picture A large solitary so-called "congenital" cyst occasionally occurs without evidence of other developmental defects Such a cyst suggests the existence of retention from a stone or inflammatory process. The rare echinococcic cysts in the pancreas are caused by the tapeworm of dogs (*Echinococcus granulosus*)

ISLET-CELL TUMORS (ADENOMAS OF THE ISLANDS OF LANGERHANS HYPERINSULINISM)

These tumors may be benign or malignant They may be encountered at any age but are observed most frequently in the fourth and the fifth decades (Fig 216)

The symptoms are related to the ability

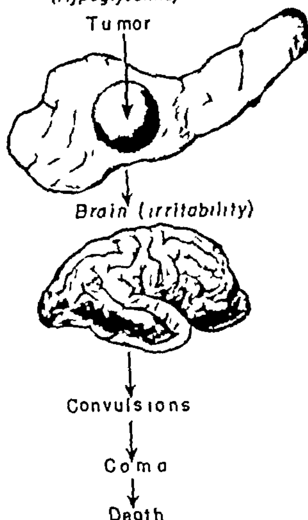


FIG 216. Islet cell tumors cause hyperinsulinism. If untreated the condition may become fatal rapidly

of these tumors to produce insulin The attacks may be intermittent and vary in severity Usually they are precipitated by abstinence from food marked physical exertion or psychic stimuli The symptoms associated with hyperinsulinism are essentially those of dysfunction of the nervous system. They have been classified as

1 Involvement of the sympathetic nervous system—dizziness pallor perspiration anorexia, nausea and vomiting

2 Involvement of the central nervous system—tonic and clonic contractions of the extremities, and convulsions

3 Psychic manifestations—mental confusion maniacal seizures amnesia and coma.

It is unfortunate when such patients are stigmatized by being admitted to psychiatric institutions Frequent or routine use of blood sugar determinations leads to a correct diagnosis The disease must be suspected when a history is obtained of intermittent attacks associated with a desire for "sweets" or after an abstinence from food

Whipple's triad is helpful in making the diagnosis It consists of

1 An attack (coma) precipitated by periods of fasting or extreme exertion.

2 Fasting blood sugar (12 hours) or during an attack below 50 mg per 100 cc.

3 Prompt relief of symptoms by the oral or intravenous administration of sugar (Fig 217)

The differentiation between benign and malignant islet-cell tumors is difficult. Seasoned pathologists have difficulty in differentiating these tumors microscopically Of clinical significance, however, is the relatively short duration of life when the tumor is malignant This is in contrast with the *long duration of symptoms associated with* the benign islet-cell neoplasms

Differential Diagnosis

Other conditions which produce symptoms referable to hypoglycemia must be considered Disturbances of the pituitary or adrenal glands associated with hypoglycemia may be substantiated by thorough studies which include roentgenograms of the skull and specific studies of adrenal function (water test of Kepler, etc.) The eosinophilic response to the injection of epinephrine is helpful Epinephrine stimulates the pituitary to secrete ACTH which depresses the eosinophil count. The normal fall should be 50 per cent of the circulating eosinophils If such a normal depression is

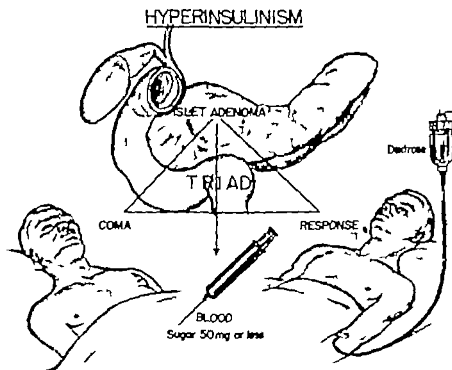


Fig 217 Whipple's triad is characteristic of hyperinsulinism (islet cell tumor) The triad consists of coma, blood sugar level below 50 mg. and immediate response to dextrose.

present serious disease of the pituitary or the adrenal cortex may be eliminated

CARCINOMA OF THE PANCREAS

Incidence

Carcinoma constitutes the most common tumor of the pancreas. *It occurs most* frequently in the fifth and the sixth decades and is twice as common in diabetics. This follows the general observation that malignant disease is more common in the diabetic.

Head as Site

The head of the pancreas is the most common site, and tumors that involve this portion may invade the pancreatic portion of the common duct and/or the portal vein. The tumors that involve the body and the tail of the organ usually attain large sizes before clinical signs and symptoms develop.

The signs and symptoms associated with carcinoma of the head of the pancreas are frequently indistinguishable from neoplasms of the periampullary area (Vater) and from carcinoma of the common bile duct (p 203). *Pain* is more common than has been thought previously. Contrary to the popular concept that painless jaundice is the outstanding characteristic of this disease, one must re-emphasize the importance of pancreatic pain as an early if not the earliest complaint. *The pain is usually dull*, epigastric, radiates to the mid-back region, is aggravated by recumbency and eating and progresses in severity. *Jaundice* is usually present but is continuous and rapidly progressive. The "P A D" triad of biliary obstruction is present, namely *P*ruritus, *A*cholic stools and *D*ark-colored urine. *Weight loss* is the most consistent symptom; it is usually rapid and severe. Fatigue is an early and insidious complaint. Anorexia, nausea, vomiting and at times diarrhea are present.

An enlarged liver is present in about 75 per cent of the cases. Despite this enlargement the organ is *not tender*, and its edge remains *relatively sharp* for many weeks. *Nodularity* does not necessarily signify liver metastases or inoperability but may be due to cystic dilatations of the intrahepatic ducts.

An *enlarged gallbladder* is usually present. Courvoisier's law is most helpful in *the differential diagnosis* (p 201). *The tumor itself is rarely palpable.*

Laboratory Data. The chief laboratory aides are tests for hyperbilirubinemia, the presence of excess fat and undigested meat fibers in the stool, hyperglycemia, increased alkaline phosphatase and occult blood in the stool. *Roentgenologic examination* may be helpful if the following can be demonstrated: enlargement and/or displacement of the duodenum and the stomach, an increased duodenal sweep, indentation of the medial aspect of the duodenum, the so-called inverted "3" sign which is formed by the presence of the 2 adjacent indentures due to a large invasive growth, and actual duodenal obstruction with mucosal irregularity produced by tumor invasion or ischemic ulceration.

Body and Tail as Sites

Carcinoma of the body and the tail of the pancreas usually present a different clinical picture. The pain, which is in the upper abdominal region, is usually constant. It assumes a girdle pattern around the upper abdomen and the lower thorax. Jaundice is absent or late. These tumors can be demonstrated by the *roentgenogram* only when they have assumed sufficient size to produce extrinsic pressure upon the surrounding structures. The mass may be palpable when the tumor involves the body or the tail.

Sarcoma

Sarcoma of the pancreas is a rare condition; however, this organ may be involved secondarily from retroperitoneal sarcoma.

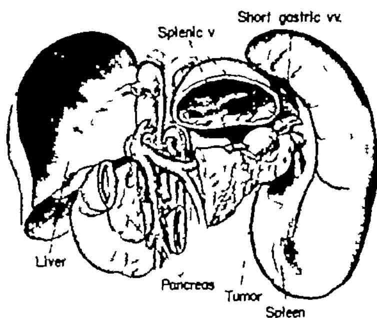


FIG. 218 Benign tu[illegible] the pancreas may cause intestinal hemorrhage [illegible] of pressure on the splen[illegible] and rupture of the short veins.

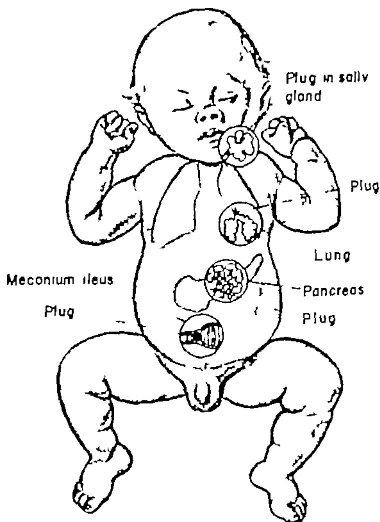


FIG 219 Fibrocystic disease of the pancreas. The signs and symptoms are caused by inspissated mucus plugs in various parts of the body

BENIGN TUMORS OR CYSTS OF THE PANCREAS

These lesions may encroach upon the splenic vein and produce dilatation and rupture of the short gastric veins (Fig 218) This must not be overlooked in the diagnosis of so-called "idiopathic" gastro-intestinal hemorrhage

CYSTIC FIBROSIS OF THE PANCREAS (MUCOVISCIDOSIS)

This is a bizarre congenital condition in which the mucus-producing glands of various parts of the body manufacture an abnormal type of inspissated viscid mucus (Fig 219) The incidence is one in every 600 to 700 infants The disease may occur as meconium ileus, a respiratory disorder or a celiac condition The celiac phase is associated with foul bulky stools The most dependable test is the determination of the trypsin content of the duodenal juice collected through a duodenal tube Trypsin in the stool may be detected by placing a diluted stool mixture on an undeveloped roentgen film Normal trypsin activity is manifested by the digestion of the gelatin on the film If absent cystic fibrosis of the pancreas should be suspected The mother may present the first clue if she notices a marked salty taste when kissing the baby because of excessive perspiration which has a high salt content

9

Spleen

Increased interest in the spleen in recent years is due to a change in concepts concerning the physiopathology and the treatment of splenic diseases

PHYSIOLOGY

This bean shaped organ contains the largest collection of lymphoid tissue and reticuloendothelial elements in the body Although many functions have been ascribed to the spleen none seem to be essential to life Apparently the reticuloendothelial system compensates and assumes splenic functions after removal of the organ In *fetal life* the spleen takes part in the formation of all types of blood cells In the *adult* however the spleen produces only lymphocytes and monocytes At any period in life it can revert to its fetal function and produce all types of blood cells.

The functions of the spleen (Fig 220) are believed to be related to

1 Blood formation
2 Blood destruction
3 Blood storage
4 Iron metabolism
5 Immunity
6 Internal secretion

Blood destruction is brought about by the spleen s ability to select ' aged" erythrocytes and reutilize their basic substances (hemoglobin and iron) It has been estimated that this organ can destroy 10,000,000 cells per second (Fig 221)—a fabulous function to say the least

Blood Regulation. The spleen acts as the regulator between the bone marrow (the blood making factory) and the peripheral blood stream (the blood cell recipient) (Fig 222) In this way the spleen will maintain the peripheral blood count of

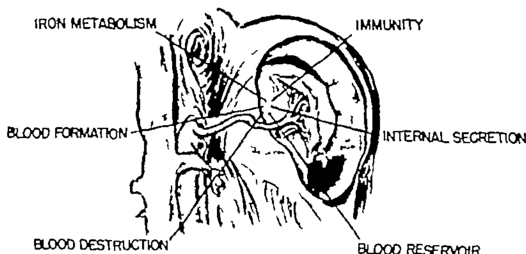


FIG. 220 The supposed functions of the spleen.

red cells between 4 000,000 and 5,000,000 the white cells between 5 000 and 10 000 and platelets between one quarter and one half million. Should this function become abnormal hypersplenism and hyposplenism may result

The storage or reservoir function of this organ can supply blood to the circulation Splenic contractions are increased by exercise and stress (increased production of adrenalin) Following any hemorrhage, the spleen contracts and attempts to autotransfuse the patient A spleen which might have been enlarged and palpable prior to the hemorrhage becomes difficult or impossible to feel after a severe hemorrhage (Fig 223)

The iron metabolism function is believed to be carried on by the reticuloendothelium of the spleen this converts hemoglobin into bilirubin

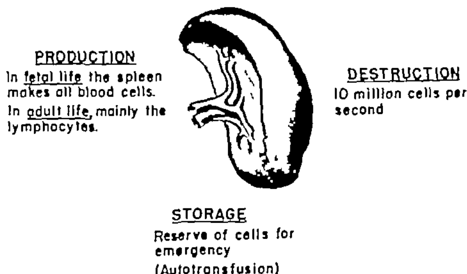


Fig. 221 Blood cell production destruction and storage are apparently important splenic functions. It should be noted that the spleen may revert to its fetal function of making all types of blood cells.

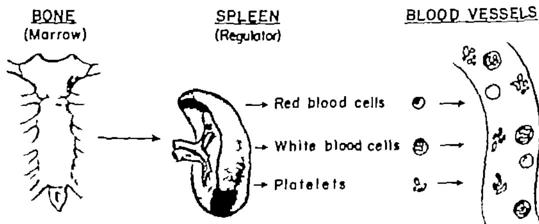


Fig 222 The spleen acts as a regulating mechanism which is placed between the bone marrow and the peripheral blood stream.

Immunity is a probable function through the formation of antibodies However, removal of this organ does not appear to interfere with the well being of an individual

Internal secretion is another questionable function Its relationship to the endocrine system is under critical study

The removal of an organ with so many functions should be avoided whenever possible

ANOMALIES

Splenic anomalies include lobulation congential absence accessory spleens and ectopic positions The two latter conditions are of particular importance

Accessory spleens are numerous in the embryo but involute after birth In congenital hemolytic icterus and thrombocytopenic purpura the number of such spleens is supposedly increased They are easily confused with hemolymph nodes They are found most frequently in the splenic hilum, the gastrosplenic ligament and in the region of the upper border and the tail of the pancreas They are clinically important because they can perpetuate symptoms of hypersplenism following splenectomy Their removal is as necessary as is the removal of the spleen proper in cases of hypersplenism, if recurrence of symptoms is to be avoided

Ectopic spleen (wandering floating or movable spleen) is due in part to elongation of the splenic ligament Symptoms vary with the position of the organ ptotic spleens are particularly prone to torsion If splenic torsion is complete the symptoms are acute, severe and dramatic, if incomplete a subacute or chronic history may be elicited (Fig 224) A correct preoperative diagnosis of torsion is a rarity, it is confused clinically with torsion of the ovary or intestinal obstruction

Of particular interest is the ectopic position of a spleen or accessory spleens to the gonad It is to be recalled that the splenic bud develops close to the embry

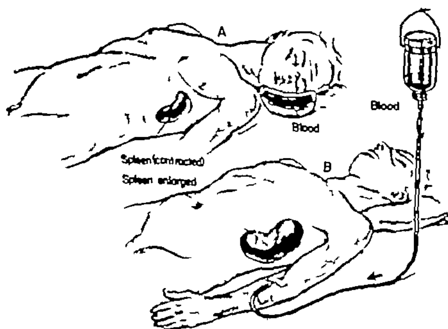


Fig 223 The spleen contracts and diminishes in size following any severe hemorrhage because it attempts to return blood to the body and autotransfuse the patient.

onic gonad (Fig 225) As the ovary or the testis descends a few splenic cells may become attached to the sex gland and descend with it. Whenever recurrent symptoms of hypersplenism appear after splenectomy, such accessory spleens must be considered

HYPERSPLENISM

This term refers to splenic hyperactivity

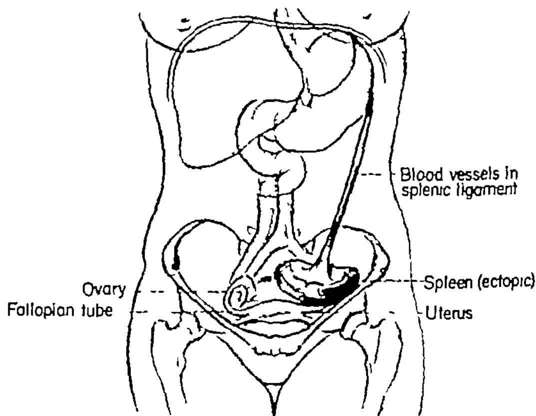


Fig 224 So-called wandering spleen in relation to the left ovary (author s case)

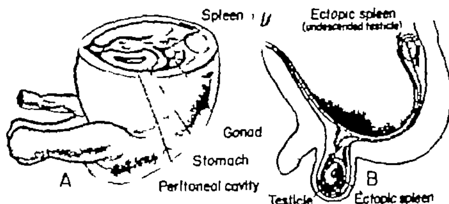


Fig 225 Ectopic spleens may be situated on the left testicle or the left ovary because these structures are closely related to each other in the early developmental period

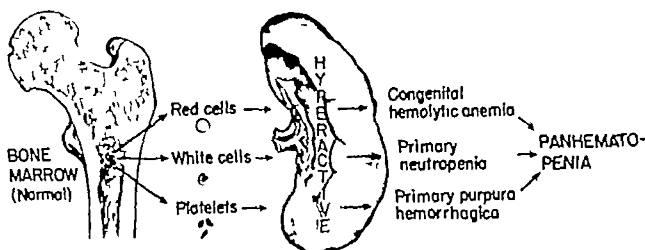


FIG 226 Hypersplenism refers to an overactive spleen Four conditions are directly related to it The type of blood cell destroyed determines the name of the condition

which results in a decrease in one or more of the blood forming elements Hematologists differ as to the mechanism Hypersplenism is classified as primary or secondary, the latter being a complication of some other disease

Four conditions are directly related to hypersplenism (Fig 226)

1 Congenital hemolytic anemia—excessive destruction of red blood cells

2 Essential thrombocytopenic purpura—excessive destruction of blood platelets

3 Primary splenic neutropenia—excessive destruction of neutrophils

4 Panhematopenia—excessive destruction of all blood elements

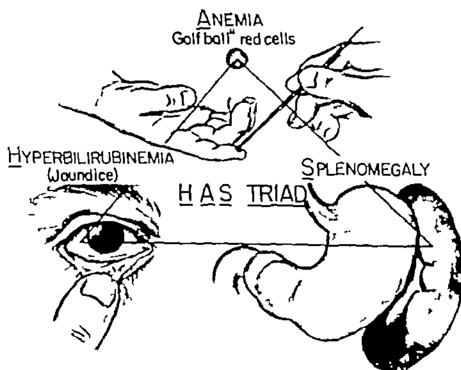


FIG 227 The H A S triad (hyperbilirubinemia anemia and splenomegaly) associated with congenital hemolytic anemia.

Congenital hemolytic anemia (congenital hemolytic icterus spherocytic icterus, acholuric jaundice Chauford Minkowski anemia) This is a familial disease that commonly occurs in several members of a given family Since the symptoms are mild unless *hemolytic crises* are present, the case may be undiagnosed There is a tendency toward exacerbations and remissions.

DIAGNOSIS The diagnosis should be made when the triad of hyperbilirubinemia, anemia and splenomegaly is present—the H A S triad (Fig 227) *Jaundice* (hyperbilirubinemia) is the most common symptom but may be overlooked since it is usually mild or may be subclinical The *anemia* is moderate of microcytic type which is characterized by the so-called golf ball red blood cells (microcytic spherocytosis) *Splenomegaly* is common, the enlarged spleen producing pressure and symptoms on surrounding structures Other findings that should suggest this condition are multiple small bilirubin gallstones, particularly in the young individuals with an *elongated tower head* and *ulcers* on the inferior extremities (Fig 228) The last have been diagnosed erroneously as varicose ulcers *one should not diagnose a varicose* ulcer unless varicose veins are present.

HEMOLYTIC CRISIS This is a critical episode in which the icterus and the anemia increase, and the patient becomes severely ill. During such crises there is a rapid depression of red blood cells and a marked increase in hemolysis The red blood cell count may drop below one million

LABORATORY DATA. This information can be particularly helpful. *Bone marrow* studies reveal an erythroid hyperplasia. The *red blood cells* represent the characteristic spherocytes with an increased fragility, the hemolysis beginning in 0 7 to 0.5 per cent saline solution (normal 0 45% saline) An increase in the number of reticulocytes is noted in the peripheral blood *The blood van den Bergh test* is elevated and indirect. *Urobilinogen* is increased in the urine and the stool. No bile (bilirubin) is present in the urine (acholuric jaundice)

It is imperative to diagnose congenital hemolytic anemia since the administration of blood transfusions may produce or aggravate a hemolytic crisis. Blood cannot be administered to these patients until the spleen is removed or until the splenic artery has been ligated

Essential thrombocytopenic purpura (*idiopathic thrombocytopenic* purpura, purpura hemorrhagica Werlhof's disease) is a

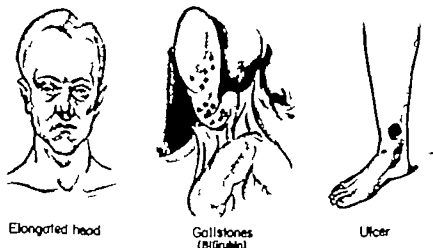


FIG 228 Individuals with elongated heads bilirubin gallstones and non varicose ulcers might be congenital hemolytic anemia patients.

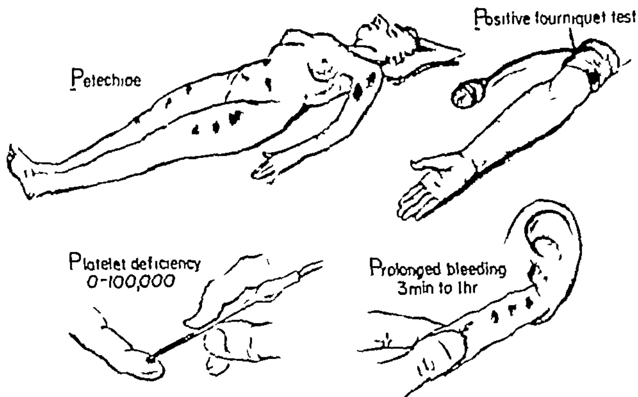


FIG 229 The cardinal findings in essential thrombocytopenic purpura. The letter "P" has been used as a mnemonic.

hemorrhagic disorder that occurs more frequently in children and young adults It is infrequent past the fourth decade, females are affected twice as often as males The cardinal findings are (Fig 229)

1 *Petechiae*
2 *Positive tourniquet test*
3 *Platelet deficiency*
4 *Prolonged bleeding time*

Petechial hemorrhages usually appear first they occur most commonly on the extremities and the abdomen Bleeding from mucous membranes is common (nose gums bowels kidneys and vagina) The most serious complication is *intracranial hemorrhage* it constitutes the most frequent cause of death in these patients

The *tourniquet test* is positive during the active phase of the disease It demonstrates the tendency for blood capillaries to rupture and produce petechial hemorrhages It is performed by occluding the *veins* of the superior extremity not the arteries for 5 minutes It has also been referred to as the Rumpel Lead phenomenon

The *blood platelets* are usually reduced below 100,000 per cu mm. (normal platelet count is between one quarter and one half million) During the quiescent stage, the platelets may number 60 000 to 100,000 however during an exacerbation the platelet count may drop to zero There is no disturbance in the leukocyte or erythrocyte count unless leukocytosis and/or anemia result from an associated hemorrhage or intercurrent infection *It is mandatory to do a platelet count on every case of bleeding regardless of the age of the patient or the source of the hemorrhage*

Prolonged bleeding time is present (normal 1 to 3 minutes) In these cases the bleeding time is over 3 minutes and may be increased to 1 hour This time is the period that elapses between capillary puncture and cessation of bleeding The clotting time remains normal The clot retraction

is totally absent or markedly delayed (normal usually from 30 to 60 minutes) Splenomegaly is *uncommon* If present, it suggests some other disease

Purpura hemorrhagica may be acute or chronic. The chronic form runs a cyclic course being associated with remissions and exacerbations

Differential Diagnosis This condition must be differentiated from secondary thrombocytopenic purpura and hemophilia Of particular value is a study of the bone marrow If the condition is one of essential thrombocytopenic purpura a megakaryocytic hyperplasia will be found

Prognosis The results following splenectomy are favorable in over 70 per cent of the patients Relapses occur more commonly in females Infants, children, and individuals over 40 years may have remissions induced by blood transfusions and conservative treatment.

Primary Splenic Neutropenia This condition, first described by Wiseman and Doan, also belongs to the primary hypersplenic diseases

It is associated with frequent infections particularly those involving the oropharynx. The diagnosis is confirmed hematologically by a severe specific neutropenia and a myeloid hyperplasia of the bone marrow A diagnostic triad may be utilized which consists of

1 Splenomegaly
2 Peripheral neutropenia
3 Bone marrow hyperplasia

The differential diagnosis includes Banti s syndrome Felty's syndrome and particularly the toxic neutropenias in which there is *an absence* of bone marrow hyperplasia

Primary Splenic Panhematopenia. In this condition there is an indiscriminate elimination of all the circulating cellular elements Although leukopenia is the most persistent feature thrombocytopenia and erythropenia are also demonstrable The signs and symptoms usually include weakness icterus repeated bouts of infection (oropharyngeal) and bleeding tendencies The diagnostic triad of this condition includes splenomegaly panhematopenia (reduction of all 3 elements of the blood), and hyperplasia of the bone marrow

SECONDARY HYPERSPLENISM

In this condition the overactivity of the spleen is associated with some other disease. The following 4 criteria are diagnostic

1 Splenomegaly
2 Evidence in the peripheral blood of a reduction of one or more of the cellular elements
3 Bone marrow hyperplasia
4 *The presence of some other disease*

Such conditions as portal hypertension (Banti's syndrome) acquired hemolytic anemia, Boeck s sarcoidosis, chronic leukemia, Hodgkin's disease and tuberculosis are a few of the diseases that are related to the syndrome of secondary hypersplenism.

HYPOSPLENISM

It is the opinion of some authorities that hypofunction of the spleen is as distinct an entity as is overactivity (hypersplenism) Whether or not such conditions as *polycythemia vera* should be considered under this heading is still debatable A condition called *agnogenic myeloid metaplasia* has been suspected of being the end result of polycythemia vera. In this myeloid metaplasia state the spleen and other organs attempt to take over the functions of a sclerosing and inadequate bone marrow The spleen becomes enlarged, supposedly the result of a compensatory mechanism. The removal of such enlarged spleens, theoretically at least, is contraindicated

Gaucher s disease is a rare familial disease characterized by splenomegaly enlarged lymph glands and peculiar pigmentations which develop on the face in the conjunctivae and on the lower legs Hemorrhagic diathesis and positive roentgenographic findings are helpful in confirming the diagnosis The roentgenograms may

reveal areas of bone destruction due to so called Gaucher's cells.' The diagnosis can be confirmed if these cells are demonstrated in the bone marrow smear The condition may be associated with secondary hyper splenism

INFECTIONS

The incidence of splenitis and splenic abscesses has diminished since the advent of the antibiotics Abscesses are most commonly located in an area of devitalized splenic pulp that is infected The diagnosis is suspected when there is pain in the splenic region which is referred to the left shoulder or the left chest a tender enlarged spleen and a septic syndrome (fever, chills, sweats and leukocytosis)

Chronic splenitis is suspected if symptoms of infection persist and a large spleen is demonstrable Occasionally this is associated with secondary hypersplenism tuberculosis Boeck's sarcoid syphilis malaria and Leishmaniasis

Felty's syndrome is characterized by splenomegaly neutropenia and polyarthritis. Splenectomy has been beneficial even affecting the arthritic manifestations in some instances

TUMORS

Neoplasms of the spleen are benign malignant or metastatic Exclusive of the lymphomas splenic neoplasms are infrequent. The spleen is rarely the site of metastatic tumors. It has been suggested that this organ possesses some protective element against malignant diseases The diagnosis is rarely made preoperatively since the symptoms are vague Splenomegaly if detected is the one finding that attracts attention The 2 most frequent tumors encountered are those associated with lymphosarcoma and Hodgkin's disease

CYSTS

Exclusive of hydatid cysts the most commonly encountered cystic involvement of the spleen is the retention type If it attains a large size, symptoms result from pressure on surrounding organs The splenic enlargement is suspected when the roentgenogram reveals the stomach displaced to the right the splenic flexure antero-inferiorly and the kidney inferiorly If the cysts have been present for months or years evidences of calcium deposits are noted The specific skin test and the compliment fixation test are of value in determining whether or not the mass is of echinococcic origin Less common are the dermoid and the epidermoid varieties of cysts

Splenic puncture although advocated by some, has too great a calculated risk to be utilized with any degree of frequency The author personally fears the procedure. When indicated, and this probably would be most infrequent, one versed in this technic should be permitted to conduct the procedure However, the attending physician must assume the risk of a probable death

RUPTURED SPLEEN

This condition should be considered in all patients who have sustained traumatic injuries, particularly those involving the left side of the abdomen or the chest. The spleen is particularly vulnerable because of its fixation by ligaments its close proximity to the ribs and its consistency Malaria syphilis tumors and other conditions that result in splenomegaly increase its susceptibility to injury Particularly in the latter instance must be mentioned infectious mononucleosis (Fig 230) Early and accurate diagnosis of splenic rupture is imperative because these patients succumb if proper treatment is not instituted rapidly

Because of the close anatomic relationship between the spleen the lower left ribs and the kidney (Fig 270) any injury to the latter 2 structures should suggest the possibility of splenic involvement Any patient with a history of trauma and a *hematuria* should have a careful evaluation of the spleen Two types of splenic injury

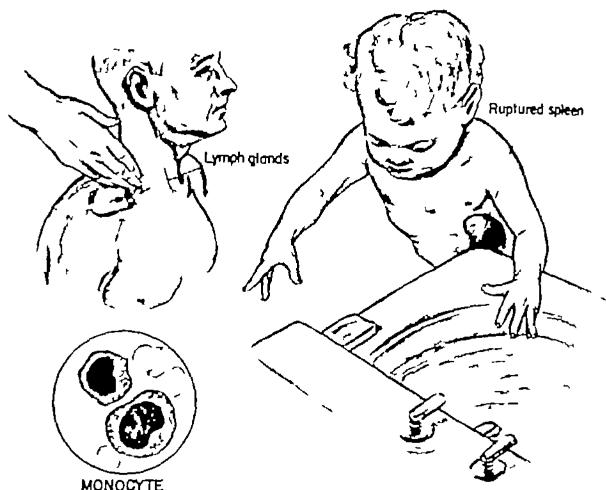


FIG. 230 Infectious mononucleosis is seen most frequently in younger individuals. It should be suspected in cases which are associated with unexplained fever, enlarged cervical lymph glands and splenomegaly are characteristic. These enlarged spleens are susceptible to trauma and rupture. The blood examination reveals an increase in monocytes

occur one associated with an intact capsule and the other in which the capsule is torn It is best to consider these separately since their clinical pictures differ

When the *capsule is intact* the bleeding is not intra abdominal The peritoneal reaction is minimal however tenderness may be elicited in the left upper abdominal quadrant. As the hemorrhage progresses it is accompanied by a gradual enlarging of the organ, which eventually becomes palpable Subcapsular bleeding has been known to distend the splenic capsule to such a degree that it contains 1 liter or more of blood Serial blood counts are particularly helpful in confirming the diagnosis of subcapsular hematoma in that they reveal a progressive secondary anemia and neutrophilic leukocytosis Straining at stool, coughing overeating or vomiting frequently results in a capsular tear When the tear occurs signs of intraperitoneal hemorrhage and shock develop

When the capsule is torn the diagnosis should be made early because a definite clinical picture is present. The trauma that precipitates the injury is followed by a "latent period" (symptomatic silence) which usually lasts from 6 to 10 hours. Later the patient develops a sudden collapse from hemorrhage. The signs and symptoms depend upon the degree of hem-

orrhage Peritoneal irritation produces pain in the left upper abdominal quadrant If the bleeding continues tenderness and rigidity appear and may involve the entire abdomen Because of the ability of the vascular system to accommodate itself to alterations in blood volume the changes in blood pressure and pulse rate may not be present this gives the clinician a sense of false security Shock (p 267) becomes apparent as the hemorrhage progresses Pain referred to the left shoulder or the left supraclavicular area is quite common If there is a splenic hematoma digital pressure made between the *left* sternocleidomastoid and the scalenus anticus will produce severe pain This phenomenon is explained by the fact that sensory branches from the splenic capsule travel to the left phrenic nerve (Fig 231) This sign has been found to be positive in some cases of subcapsular hematoma with an intact capsule Saegesser is of the opinion that whenever the sign is present it justifies surgical exploration for an injured spleen Another diagnostic aid that can be used with caution is the roentgenogram taken in the Trendelenburg position after the patient has had a

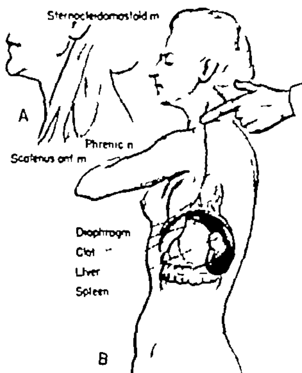


Fig 231 When a ruptured spleen results in a subdiaphragmatic hematoma pain can be elicited by pressing the left phrenic nerve Pressure on the nerve should be made supraclavicularly in an angle formed by the sternocleidomastoid and the scalenus anticus muscles.

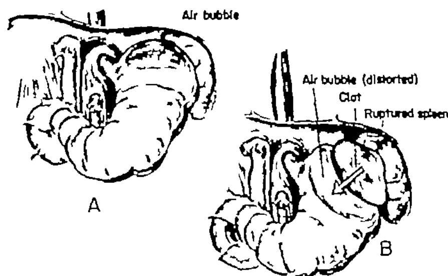


Fig 232 Medial displacement of a gastric air bubble (*magen blase*) by a splenic hematoma. If present this is readily demonstrated by the flat roentgenogram.

small swallow of barium If free fluid (blood) is present in the lesser peritoneal sac or in the upper left abdominal quadrant there will be an area of separation between the barium in the cardiac end of the stomach and the diaphragm The flat roentgenogram may reveal medial displacement of the splenic flexure and the proximal descending colon a distorted air bubble (*magenblase*) in the stomach and possibly an enlarged 'splenic' shadow (Fig 232) The psoas muscle shadow is helpful in differentiating such displacement from a retroperitoneal mass If the suspected lesion is retroperitoneal the psoas shadow usually is obliterated Further roentgenographic evidence reveals an elevation of the left hemidiaphragm and serration of the greater curvature of the stomach

Percussion elicits an increased area of splenic dullness and obliteration of gastric tympany (Traube's space)

Abdominal auscultation reveals a diminution in intestinal sounds as the hemorrhage progresses When the peritonitis becomes diffuse these sounds are absent

Laboratory data may be helpful however the red blood cell count and hemoglobin do not decrease until later depe[nding on] the severity of the hemorrhage. The white blood cell count becomes elevated early often reaching 18,000 to 20,000 therefore, it is of greater diagnostic significance. *Abdominal tap*" as a diagnostic aid is mentioned to be condemned A negative tap does not rule out the diagnosis of a ruptured spleen Some authorities advocate such taps in each of the 4 abdominal quadrants Apparently those who advocate such peritoneal harpooning do not realize the safety with which an exploratory operation can be conducted

THROMBOSIS OF THE SPLENIC VEIN

This may be a primary condition due to a congenital anomaly, however, it can be associated with various types of infection. Bleeding esophageal varices are associated with this condition and must be differentiated from portal hypertension If the hypertension is intrahepatic, the liver function tests will be positive The diagnosis is important because splenectomy is curative in splenic vein thrombosis.

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10

Hernia

The varieties of hernia can be differentiated as to time location, causation, contents and reducibility Unfortunately, there is no simpler way to discuss the subject

A *hernia* (rupture) is an abnormal protrusion of a viscus and its sac through the walls of the cavity that it normally occupies *Prolapse* also refers to the escape of a viscus through an anatomic opening, however, the protruding part is not covered by a sac.

CLASSIFICATIONS

1 **As to Time**

A *Congenital* a hernia that exists at birth

B *Acquired* one that develops after birth

2 **As to Location**

A. *External* hernias protrude through the parietes the underlying sac and its contents being situated under the skin.

B *Internal* hernias lie within the abdomen (intersigmoid fossa, pericecal fossae, foramen of Winslow etc.)

C *Inguinal* hernias involve the inguinal region

D *Femoral* hernias traverse the femoral canal

E Miscellaneous locations such as ventral obturator, lumbar perineal sciatic, vaginal pudendal and diaphragmatic.

F *Interstitial* hernias are located between the layers of the abdominal wall.

3 **As to Contents**

A *Epiplocele* contains omentum.

B *Enterocele* contains small intestine

C *Cystocele* contains urinary bladder

D *Cecocele* contains the cecum

E *Richter's* hernia contains only a part of the circumference of the bowel

F *Littre's* hernia as described by Alexis Littre the hernial sac contains a Meckel s diverticulum (Fig 233)

4 **As to Causation**

A Traumatic

B Postoperative (incisional)

5 **As to Reducibility**

A. Reducible when the contents are returned to the abdominal cavity, either spontaneously or by manipulation (taxis)

B Irreducible when the contents cannot be returned to the abdomen

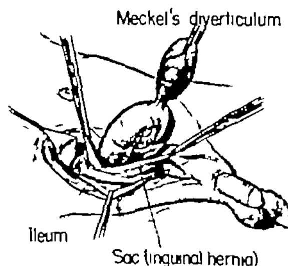


Fig 233 Littre s hernia. This inguinal hernia contains a Meckel s diverticulum

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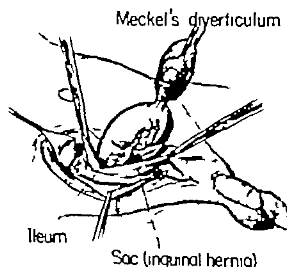


FIG 233 Littre's hernia. This inguinal hernia contains a Meckel's diverticulum.

ETIOLOGY

Hernias occur commonly during infancy and between the ages of 15 and 50 Umbilical hernias of childhood are seen equally in the sexes but after middle life are more frequent in females Heredity plays a part in that there is a history of similar herniations in about 25 per cent of the cases.

Those specific hernias which are considered most important and most common will be discussed

- Inguinal
- Sliding
- Femoral
- Ventral
  - Median
  - Lateral
  - Incisional
- Internal

INGUINAL HERNIA

These hernias constitute about 85 per cent of all hernias They are more common in men than women because the descent of the testicle makes the inguinal canal larger and more vulnerable Hernias occur more frequently on the right side probably because of the later descent of the right testicle Inguinal hernias may be of 2 types indirect or direct They should be considered as 2 entirely different conditions and will be discussed as such

Indirect Inguinal Hernia

This has been referred to as an oblique or lateral inguinal hernia.

Indirect inguinal hernia is an *embryologic* hernia since it is related to the descent of the gonad (Fig 234) Therefore this type of hernia follows the course of the spermatic cord as far as the scrotum, or the round ligament into the labium majus As the hernia leaves the internal abdominal inguinal ring it traverses the inguinal canal and emerges at the external (subcutaneous) inguinal ring

As the testicle descends it pushes together the 2 leaves of peritoneum which extend downward toward the scrotum If descent of the testicle fails, the peritoneal prolongation remains open (Fig 234 B) Therefore, in *every* case of undescended testicle there must be an associated indirect inguinal hernia. The 2 peritoneal layers which form the vaginal process may not fuse firmly despite the normal descent of the testicle, a potential embryologic weakness then ex

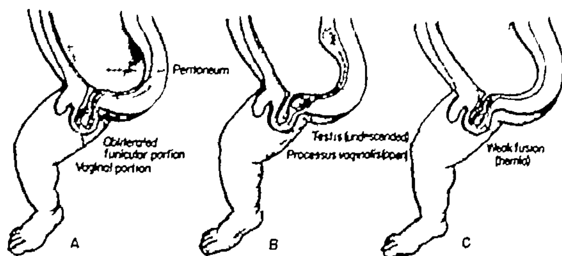


Fig 234 Indirect inguinal hernia. (A) Normal descent of the testicle and obliteration of the processus vaginalis (B) In every case of undescended testicle there is an associated indirect inguinal hernia (C) When the fusion of the layers of the processus vaginalis is weak an indirect inguinal hernia can develop.

ists, and a hernia may develop (Fig 234 C) If such a hernia is present at birth it is referred to as *congenital*, if it develops after birth it cannot be called congenital, however, it is nevertheless embryologic.

Age plays an important role in the diagnosis, because an indirect inguinal hernia appears in younger individuals These hernias are seen more frequently before middle life (40 to 50)

This hernia (slow to appear) does not immediately pop out when the patient stands (Fig 235) The patient states that it usually reduces itself *slowly* or disappears while he is asleep This is explained by the fact that this type of hernia has to find its way gradually through the *small* internal inguinal ring The smallness of this ring also explains the need for reduction (taxis)

Scrotal hernias are a type of indirect inguinal hernias They must be differentiated from scrotal masses (testicular tumors, hydroceles etc.) (See p 252)

Strangulated inguinal hernias are practically always *indirect* This also is explained by the fact that the internal inguinal ring is narrow and predisposes to constriction around the hernial contents The term "strangulated" should not be confused with 'incarcerated," since the latter refers to irreducibility When a hernia becomes strangulated it is irreducible to be sure but its blood supply is also interfered with

A specific impulse is transmitted to an examining finger placed in the external inguinal ring if an inguinal hernia is present In the indirect inguinal variety the hernia descends along the inguinal canal traveling from lateral to medial Therefore this type of hernia would touch the *tip* of the examining finger (Fig 236) This can be demonstrated readily if the patient is asked to cough or strain

Direct Inguinal Hernia

Direct inguinal hernia is an *acquired* type

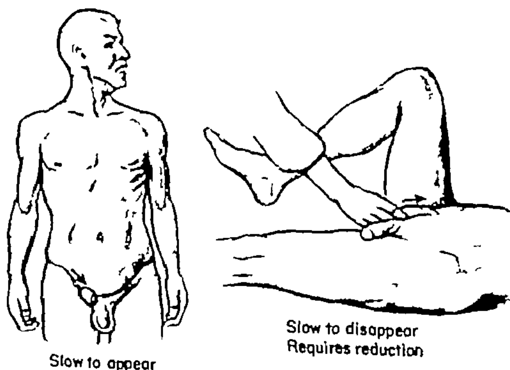


Fig 235 An indirect inguinal hernia is slow to appear and slow to disappear Frequently it requires reduction This is explained by the small caliber of the internal inguinal ring.

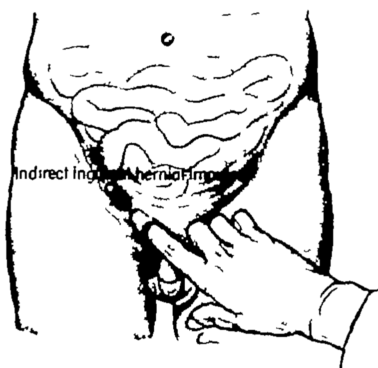


Fig 236 The impulse transmitted from an indirect inguinal hernia touches the *tip* of the examining finger

of hernia It is not related to the embryologic descent of the testicle but is dependent upon the weakening of the transversalis fascia in Hesselbach s triangle Such tissue weakness usually occurs later in life (40 to 60 years)

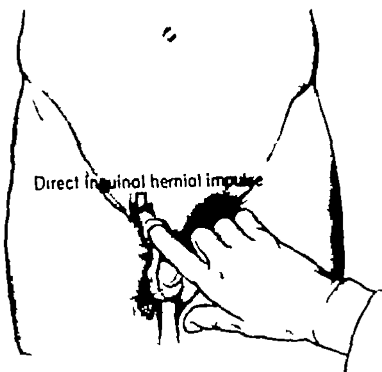
These hernias *appear rapidly* as the patient assumes an erect posture the hernia pops out. The bulge appears at the middle of Poupart s ligament. Direct hernias *disappear* rapidly and spontaneously (Fig 237) The explanation for such rapid appearance and spontaneous disappearance is the fact that there is no narrow ring to form a constricting neck. Hesselbach s triangle through which this hernia protrudes is a wide fossalike space.

Direct hernias do not become scrotal,



Fig. 237 Direct inguinal hernias appear rapidly (popout) and disappear without requiring reduction when the patient is supine.

Fig 238 The impulse transmitted from a direct inguinal hernia touches the *pulp* of the examining finger



because they do not follow the path of the descending testicle They merely bulge toward the inguinal canal approaching it from the medial side

These hernias *do not strangulate* because they are associated with a wide mouthed fossa (Hesselbach s triangle) and not with a constricting ring

An *impulse* is transmitted when patients with direct inguinal hernias cough or strain (Fig 238) However, this impulse contacts the *pulp* of the examining finger lifting the distal end of the digit upward

Differentiation of these two types of hernias is important because the recurrence rate in direct hernia is greater surgery is imperative in the indirect variety and the treatment of each is entirely different. They cannot be differentiated clinically by feeling the pulsations of the deep epigastric artery, because this vessel is not palpable under normal circumstances The differential diagnostic points are tabulated in the next column

The author has found it helpful to liken inguinal hernias to a pair of pants (Fig 239) The indirect inguinal variety is like the new (young) pair of pants in which the seam (vaginal process) is the predominant weak point Should such a torn seam be taken to a tailor the defect is corrected readily by merely suturing it. The same applies to the surgical correction of an indirect inguinal hernia by high ligation of the sac (seam) A direct inguinal hernia

Differential Diagnosis

Indirect Inguinal Hernia	Direct Inguinal Hernia
Embryologic	Acquired
Young man s hernia (under 50)	Older man s hernia (over 50)
Appears slowly	Appears rapidly
Disappears *slowly* (requires reduction)	Disappears rapidly (spontaneous reduction)
May become scrotal	Not scrotal
May strangulate	Strangulation very rare
Impulse touches *tip* of examining finger	Impulse touches *pulp* of examining finger

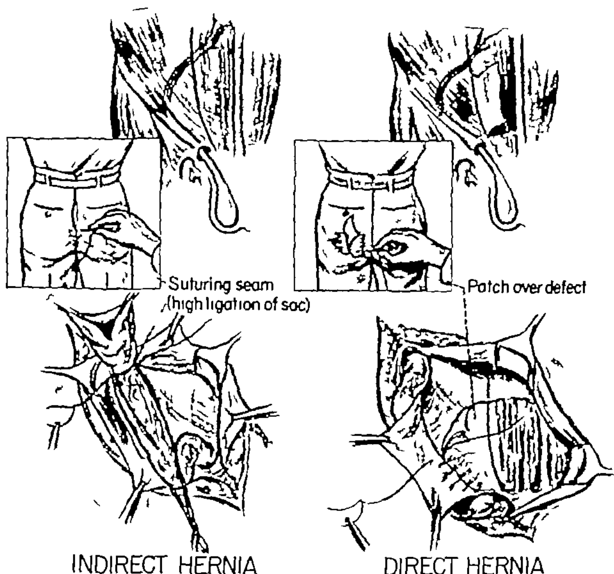


Fig 239 Comparison of inguinal hernias to a pair of pants. The indirect variety is a defective seam (vaginal process) which must be resutured (high ligation of the sac) The direct variety is a worn out piece of cloth (transversalis fascia) which must be patched.

would be represented by an older pair of pants in which the seam (vaginal process) has held for many years but the cloth (tansversalis fascia) is getting threadbare and tearing, If such a pair of pants were taken to a tailor he would attempt to find a cloth similar to the torn one and patch it This is what should be done in correcting direct hernias where a patch (rectus sheath) is placed over the weakened part of transversalis fascia.

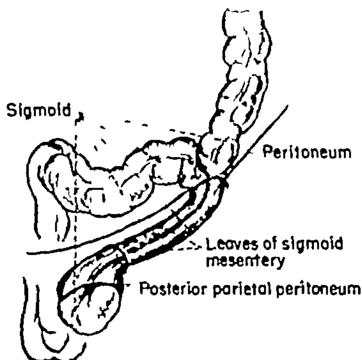
SLIDING HERNIA

This is a variety of indirect inguinal hernia in which a viscus (*sigmoid cecum* or bladder) "slides" into the sac and forms part of it (Fig 240)

Sliding hernias have the following characteristic triad (Fig 241)

1 They are scrotal
2 They are irreducible
3 They rarely strangulate

Fig 240 A sliding hernia in which the sigmoid makes up part of the sac.



No strangulation

TRIAD

Bowel

Scrotal

Irreducible

Fig 241 The diagnostic triad of sliding hernia, they are scrotal irreducible and rarely strangulate

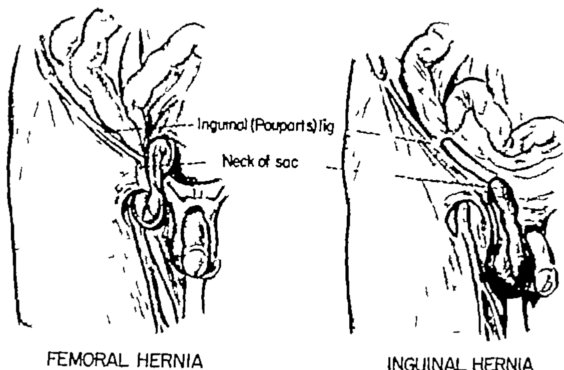


FIG 242 The *neck* of the sac of a femoral hernia is *below* the inguinal (Poupart's) ligament the neck of the sac of an inguinal hernia is *above* the inguinal ligament.

Since the inguinal canal and the internal inguinal ring are widely dilated in this type of hernia, strangulation is rarely to be feared. It is impossible to ligate the sac high because a viscus constitutes part of the sac. These hernias must be included in the differential diagnosis of scrotal masses (see p 252)

FEMORAL HERNIA

This hernia is *below* the inguinal ligament in contradistinction to inguinal hernia which is above the ligament. It occurs more commonly in women because of the wider pelvis the broader femoral canal and the poorly developed iliopsoas muscle However it is less frequent in women than inguinal hernia.

It must be emphasized that a femoral hernia may travel downward through the *femoral canal, come out the femoral ring* beneath Poupart's ligament and then change its course turning upward over Poupart's ligament. This explains why a femoral hernia is readily confused with an inguinal hernia It is the relation of the *neck* of the sac to Poupart's ligament rather than the fundus of the sac which avoids confusion with inguinal hernia. In the case of a femoral hernia the neck of the sac is below Poupart's ligament, in inguinal hernia the neck of the sac is above Poupart's ligament (Fig 242)

To differentiate an inguinal hernia from a femoral hernia one should place the examining finger in the external inguinal ring of the suspected side if the bulge is a femoral hernia, the inguinal ring and canal will be empty Since the femoral ring is a narrow one and since the lacunar (Gimbernat's) ligament is an unresisting band strangulation is frequent. The femoral canal is not open at birth, hence this type of hernia is rarely seen before the second decade

The *differential diagnosis* must include subperitoneal lipoma, aneurysm of the

femoral artery, saphenous varix and enlarged lymph nodes

A saphenous varix at the fossa ovalis closely resembles a femoral hernia because it forms a soft swelling It is reducible on pressure or recumbency, and transmits an impulse on coughing Two things, however, should call attention to the varix the presence of other varicosities on the thigh or the leg and a percussion impulse transmitted to the varix (Fig 243)

Enlarged lymph nodes in the region of the fossa ovalis may press on the genitofemoral nerve and produce reflex vomiting which suggests a strangulated hernia The so-called suppurating gland of Cloquet when reddened and inflamed, may closely resemble a strangulated femoral hernia It is important to examine the entire extremity particularly the foot and the area between the toes, for the primary source of infection

VENTRAL HERNIA

In a broad sense any hernia which involves the abdominal wall can be considered a ventral hernia Inguinal femoral and umbilical hernias are treated as specific varieties The ventral hernias per se are divided into 3 types (Fig 244) (1) mid line (2) lateral and (3) postoperative

Mid-line Ventral Hernias

Mid line ventral hernias have been referred to as divarications of the recti, linea alba (epigastric) hernia and diastasis of the recti muscles *Divarication* of the recti

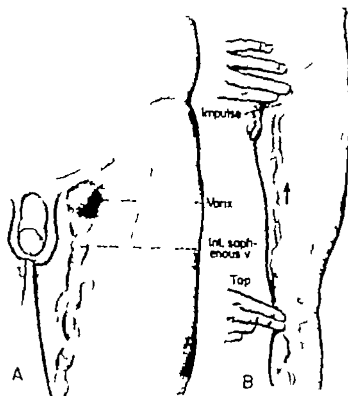


FIG 243 A saphenous varix at the fossa ovalis can be differentiated from a femoral hernia by the presence of varicose veins leading to the varix and the demonstration of an impulse when tapping a lower vein

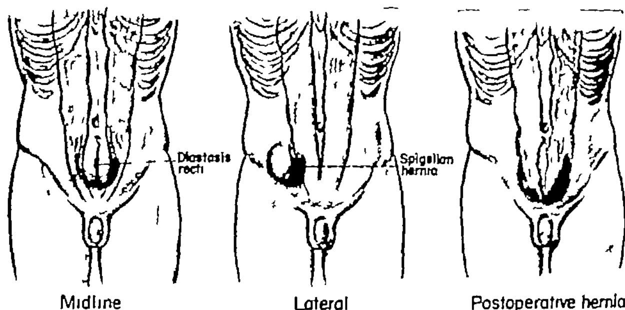


FIG 244 Ventral hernias may be divided into mid-line, lateral and postoperative.

is a separation of these muscles which occurs usually between the navel and the xiphoid and is present frequently in children. As the child strains a supra-umbilical protrusion in the mid line is noted This is usually transient and disappears as soon as the muscles develop Rarely is any surgical therapy indicated however the parents require reassurance

Linea alba (epigastric hernia) also occurs between the navel and the xiphoid it is found more commonly in adults particularly males in the third decade who are engaged in strenuous labor This hernia is composed of extraperitoneal fat which protrudes through a meshwork of interlacing fibers in the mid line This mass is small, globular and usually irreducible, it becomes

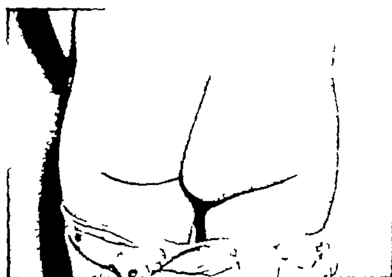


FIG 245 This asymmetry of the buttocks is produced by a gluteal hernia. *If the gluteal mass is a hernia it transmits* an impulse on coughing or straining and frequently it can be reduced.

extremely painful if it strangulates This must be differentiated from lipomas and other tumors and cysts in the mid line *Diastasis of the recti muscles* can occur anywhere along the linea alba but is found most frequently infra umbilically Multiparous women who present a marked relaxation of the anterior abdominal wall are particularly predisposed *One can test for a* diastasis by having the patient, who is supine raise the body upward from the hips and watch for a bulging between the recti

Lateral Ventral Hernias

Lateral ventral hernias (spigelian hernia) are not frequent They occur at the linea semilunaris which marks the lateral border of the rectus abdominis muscle The weakest point is usually at that site where the inferior epigastric artery enters the rectus muscle These hernias should not be confused with tumors or cysts since the hernia is usually reducible and transmits an impulse on coughing or straining

Postoperative Hernias

Postoperative hernias may follow any operative procedure, it is particularly common in males who have had upper abdominal surgery or females who have had pelvic surgery Predisposing factors to the development of such hernias are wasting of the muscles nerve paralysis, faulty abdominal wall closures infection drains and malnutrition The hernial sac is usually adherent to the abdominal wall, it may be lobulated and therefore confused with lipomas They may strangulate and produce intestinal obstruction (pp 166-167)

Such hernias as obturator sciatic retroperitoneal and internal are rare *Gluteal hernias* are rare however, they must be suspected whenever an asymmetry is discovered in the buttocks (Fig 245) Such masses must be differentiated from tumors and cysts, however, the hernia can frequently be reduced and it transmits an impulse on coughing or straining Roentgenograms may be helpful

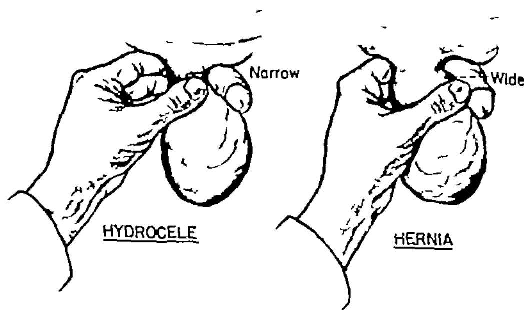


Fig 246 A scrotal mass per se does not affect the width of the spermatic cord in the region of the external inguinal ring A scrotal hernia however is associated with a marked increase in the width of the spermatic cord

SCROTAL SWELLINGS

The differential diagnosis between an indirect inguinal scrotal hernia and a hydrocele may cause confusion. A hydrocele transilluminates light however, if an appreciable amount of blood is present in the tunica vaginalis, transillumination will not be demonstrable If a scrotal hernia contains large bowel (cecum or sigmoid) these gas-containing viscera may transilluminate light Although helpful in most instances, translucency is not pathognomonic. A more certain method of differentiating these 2 conditions is the relationship of the size of the spermatic cord to the scrotal mass (Fig 246) If the scrotal mass is a hydrocele the examiner's fingers can be placed around a normal spermatic cord at the external inguinal ring However if the scrotal mass is due to a hernia it is difficult to get above the swelling since the fingers must incorporate the spermatic cord, the hernia and its contents which are very wide Another helpful method although not as accurate, is 'weighing" the scrotal mass Hydroceles are heavier than hernias

Nontranslucent chronic swellings of the scrotum should call to mind malignant disease of the testes, tuberculosis of the epididymis and gumma of the testicle. Acute testicular swellings usually are caused by epididymitis or torsion of the testicle (Fig 252)

An encysted hydrocele of the cord may be confused with an indirect inguinal hernia The former does not transmit an impulse on coughing and it is not reducible unless a communication with the abdominal cavity exists A simple method of differentiating the two is to place gentle traction caudally on the testis It will be noted that if the mass is a hydrocele of the cord it will move with the testis with traction (Fig 247)

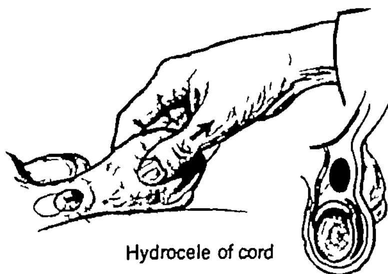


FIG 247 To differentiate a hydrocele of the cord from an indirect inguinal hernia gentle traction should be made on the testis caudally If the mass is a cord hydrocele it will move with the cord.

11

Genito-urinary Conditions

Under this heading will be included only those conditions which more commonly fall into the realm of general surgery. Therefore this section is divided into

1. Urologic conditions causing abdominal pain
2. Hematuria
3. Scrotal enlargements

Trauma involving the genito-urinary tract is discussed in Chapter 13

UROLOGIC CONDITIONS CAUSING PAIN

Renal and ureteral pain is due to an increase in pressure within the kidney capsule the renal pelvis or the ureter Such obstructions produce referred abdominal pain which follows the course of the kidney the ureter and the bladder Some authorities believe that involvement of various segments of the ureter result in different locations of referred pain Hence they state that upper ureteral lesions produce pain radiating over the crest of the ilium whereas involvement of the lower segments of the ureter is associated with pain which passes into the groin the genitalia, and the medial aspect of the thigh (Fig 248) The pain may radiate to the right upper abdominal quadrant and cause diagnostic confusion Such exceptions are difficult to explain

If a ureteral obstruction is complete the pain is more severe and colicky, and the referred pain pattern is more typical However, if the obstruction is partial renal tenderness is frequently absent, and the pain may not appear in the costovertebral angle In the latter instance the pain approximates the segmental distribution

When the right kidney or ureter is involved, the pain and the tenderness can simulate acute appendicitis The history and the physical findings usually will differentiate the two The term "Murphy punch suggests a pugilistic approach to surgical diagnosis Rough or punching maneuvers have no place in our diagnostic armamentarium Specific tenderness and spasm of the erector spinae muscle group can be demonstrated by gentle palpation which will give adequate information A patient suffering with colicky pain moves about but one affected with peritonitis lies perfectly quiet (Fig 249) Examination of the urine may reveal pus blood or clumping However if the obstruction is complete the urine on the involved side will be blocked, and the urinalysis will be normal

The importance of emergency intravenous urograms *without* cleansing enemas (if such enemas are contraindicated) cannot be overemphasized Such urograms frequently reveal the site of the lesion.

The flat roentgenogram is also helpful since it reveals a calculus in about 85 per cent of the cases

Bradycardia is particularly suggestive of a renal or a ureteral block

HEMATURIA

All the causes of hematuria are too nu

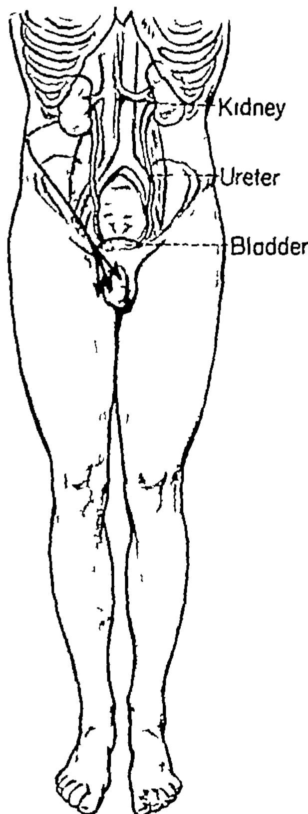


FIG. 248 Renal (ureteral) pain is referred downward along the course of the kidney the ureter and the bladder

merous to present. Some of the more common ones, however, are depicted in Fig 250 One must *never forget the possibility of a* blood dyscrasia. An acutely inflamed appendix which is in direct contact with the ureter may also cause hematuria.

If blood appears at the beginning of micturition and then disappears, a urethral lesion must be suspected if blood is present throughout the entire act of micturition, a lesion of the kidney is probably present If the urine is clear at the beginning of micturition and becomes bloody at the end, a lesion involving the bladder must be sought (Fig 251)

The differential diagnosis must include *retroperitoneal tumors* These may be divided in a broad sense into 3 categories

1 Tumors arising in organs which are located in the retroperitoneal space

2 Primary or metastatic tumors which involve the retroperitoneal lymph nodes

3 Unattached tumors (lipomas cysts fibromas, dermoids malignant tumors etc.

Some of the more specialized methods used in the differential diagnosis of these lesions are pyelography pneumography (gas introduced into the retroperitoneal space either by the lumbar or the presacral route) and arteriography Some of these methods are not without danger

SCROTAL ENLARGEMENTS

Although the scrotum contains few structures enlargements in this region may present diagnostic difficulties. Four outstanding points must be established in the history

1 Onset—acute or chronic

2 Presence or absence of pain

3 History of trauma

4 The duration of the enlargement

It has been found helpful to divide such swellings into painful and painless lesions (Fig 252) The *painful* enlargements in-

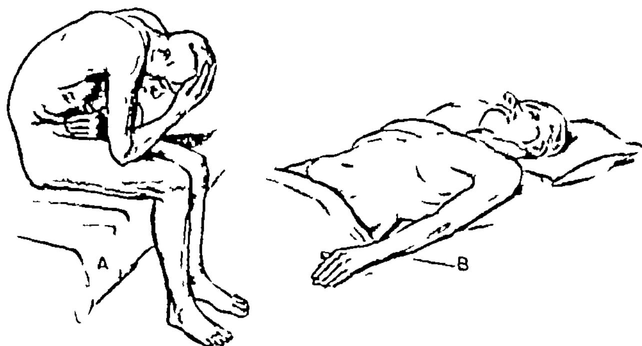


FIG. 249 Colic or peritonitis? (1) The patient with colic moves about or sits (2) The patient with peritonitis lies perfectly quiet.

clude epididymitis acute orchitis and torsion of the testicle The *painless* enlargements include hydrocele, hematocele tumors of the testicle, spermatocele, varicocele and *nonstrangulated* indirect inguinal hernias The differential diagnosis of these conditions has been discussed under their respective headings

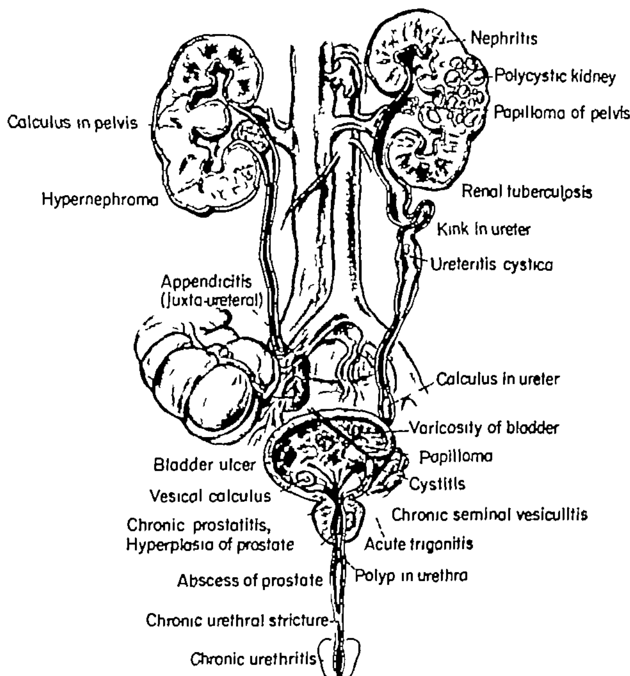


FIG. 250 Some of the more common causes of hematuria

Lesion
Blood
Clear
Lesion
Blood
A
Blood
B
Tumor
Blood
Clear
C

FIG 251 If blood appears at the beginning of micturition and then disappears a urethral lesion is suspected If blood is present throughout the entire act of micturition, a kidney lesion is probably present, if the urine is clear at the beginning of mic turition and then becomes bloody, a bladder lesion is the probable cause

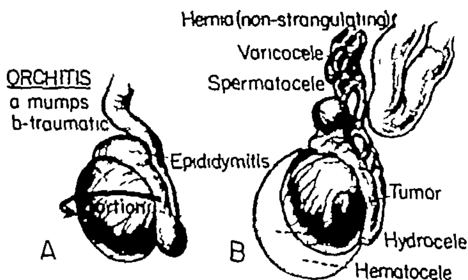


FIG 252 Differential diagnosis of scrotal swellings.

12

Gynecologic Conditions

A few gynecologic conditions warrant discussion in a text dealing with surgical diagnosis because of the differential diagnostic problems which arise These conditions include

1 Gonorrhea and its complications
2 Ectopic pregnancy (ruptured and unruptured)
3 Twisted pedicles (ovarian cysts and fibroids)
4 Endometriosis

GONORRHEA AND ITS COMPLICATIONS

This condition accounts for over 80 per cent of infections in the fallopian tubes The gonococcus is a fragile organism nevertheless it spreads rapidly through the endometrium and into the tubes Suppuration occurs, and frank pus exudes from the fimbriated ends of the tubes, resulting in a pelvic peritonitis Because of the deep position of the pelvic peritoneum and the low virulence of the organism the infection remains somewhat localized however, the tubes, ovaries, omentum and bowel are involved frequently This tendency to involve more than one structure permits one to consider this subject under the heading of "pelvic inflammatory disease"

Pelvic inflammatory disease usually is associated with other stigmata of gonorrhea hence such sites of infection should

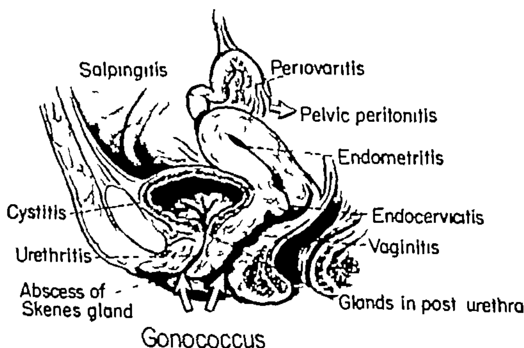


Fig 253 Sites of gonorrhea in the female.

be sought for They are represented by infections of the Bartholin glands abscess of Skene s gland vaginitis endocervicitis, endometritis salpingitis tubo-ovarian abscess and pelvic peritonitis (Fig 253) The lesions just enumerated are found in adult women, the exception is vaginitis, which appears only in childhood (juvenile vaginitis) The *onset* of an attack of pelvic inflammatory disease is related to the menstrual period appearing immediately before, during or after menstruation The *pain* is quite constant and characteristically starts in the lower abdomen, this being an important differential diagnostic point since most cases of appendicitis start in the epigastrium. *Backache* is a common complaint. Disturbances in appetite (anorexia, nausea and vomiting) are not as frequent as in appendicitis Although a pelvic peritonitis may be present the patient does not appear to be seriously ill. In acute salpingitis the fever may reach 101° to 103 and the pain may be bothersome but the patient s general appearance is good In contrast with this by the time a patient with acute appendicitis has severe pain and fever he usually appears to be seriously ill If pelvic inflammatory disease localizes to the right lower quadrant and tenderness is present in the region of McBurney s point, the differential diagnosis between it and acute appendicitis is most taxing Localization in the right lower quadrant in cases of salpingitis is explained by the ' watershed ' action of a redundant sigmoid which directs the pus and the exudate to the right (Fig 254)

The *vaginal and rectal examinations* are particularly helpful in the differential diagnosis If a vaginal discharge is present it may contain gonococci however, this organism disappears rapidly and may be difficult to demonstrate Positive smears may be found in Bartholin or Skene's glands Bimanual vaginal examinations are conducted if the hymen is not intact, rectal examinations are conducted but of more value than either of these is the so-called bidigital examination (Fig 136) This is accomplished by placing the index finger in the vaginal orifice and the middle finger in the anal orifice. One can immediately differentiate a fecal mass from the cervix and the adnexae The examiner should attempt carefully to

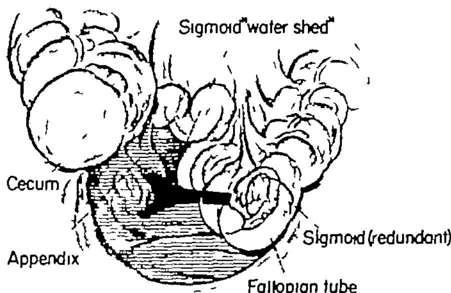


Fig 254 Pus from an infected left fallopian tube is directed to the region of the appendix by the "watershed" action of a redundant sigmoid.

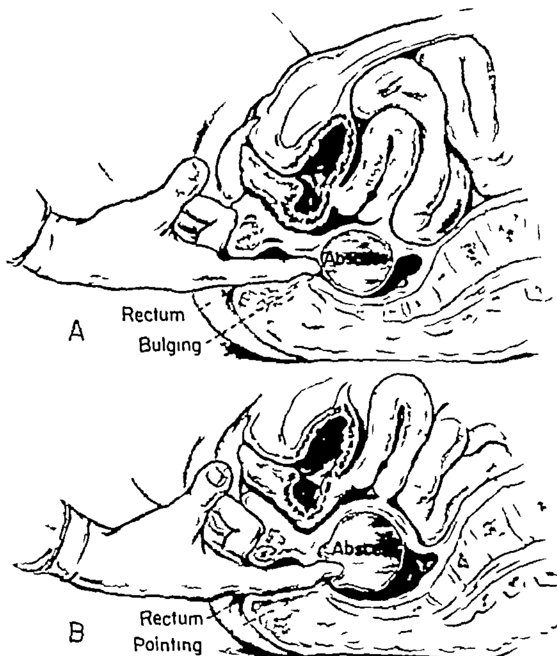


Fig 255 Bulging or pointing? Bulging masses present a firm rounded resistance. Pointing is produced by a fluctuant mass and presents a "soft spot' in the rounded mass.

elicit pain on moving the cervix This is one of the most characteristic and constant findings of pelvic inflammation Induration bulging or distinct masses may be identified in the lateral *fornices*. The *posterior* cul-de sac, if involved may also present a distinct bulging Although tenderness is present over the abdomen muscle spasm is not marked Unlike neoplasms inflammatory masses do not present a sharply defined margin but rather a bulge or resistance

Signs of small bowel nonstrangulated complete or incomplete intestinal obstruction appear when loops of ileum become attached to the inflamed area (p 167)

If a *pelvic abscess* develops the examin

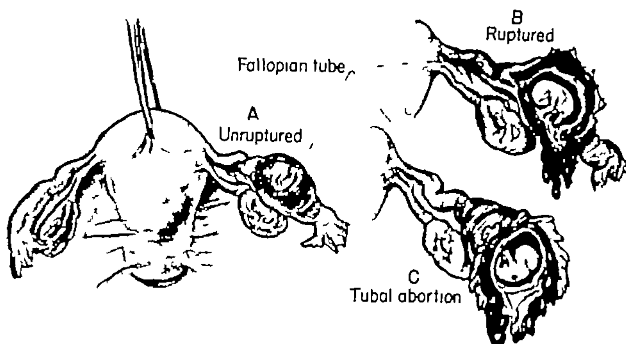


FIG 256 Ectopic (tubal) pregnancy can be divided into (1) unruptured, (2) ruptured and (3) tubal abortion.

ing finger can detect *immediately* whether this mass is bulging or pointing Bulging is as the name signifies a forward resistance however if this mass is fluctuant it will point the latter resembles the soft over ripened spot on an apple or a pear (Fig 255) If the latter is present the mass is ready to be opened

The direct diagnosis of pelvic inflammatory disease is important because in most instances this condition may be treated conservatively elective surgery can be delayed or frequently avoided. Despite all of our differential diagnostic acumen the seasoned physician knows that in some instances it is impossible to differentiate acute salpingitis from acute appendicitis If such a dilemma exists it is better to err on the side of safety and explore

Ruptured graafian follicle (so-called mittelschmerz) may simulate pelvic inflammatory disease or acute appendicitis It occurs in the intermenstrual phase at that time when the graafian follicle ruptures The degree of hemorrhage will determine the extent *of peritoneal irritation If the diagnosis is* in doubt, exploration is advised Unless a well-developed peritonitis is present these cases lack signs of inflammatory disease and rarely, if ever present an appreciable elevation in fever or in the white blood count.

ECTOPIC (TUBAL) PREGNANCY

By ectopic pregnancy is meant the development of a fertilized ovum in any place other than the uterine cavity When such fertilized ova develop in the fallopian tube we refer to this as a tubal pregnancy In tubal gestation growth of the ovum produces tubal distention the eroding action of the villi result in a thinning and tearing of the tubal wall This condition should be differentiated into

1 Unruptured tubal pregnancy
2 Ruptured tubal pregnancy
3 Tubal abortion (Fig 256)

UNRUPTURED TUBAL PREGNANCY

In an unruptured tubal pregnancy there is a gradual oozing of blood into the peritoneal

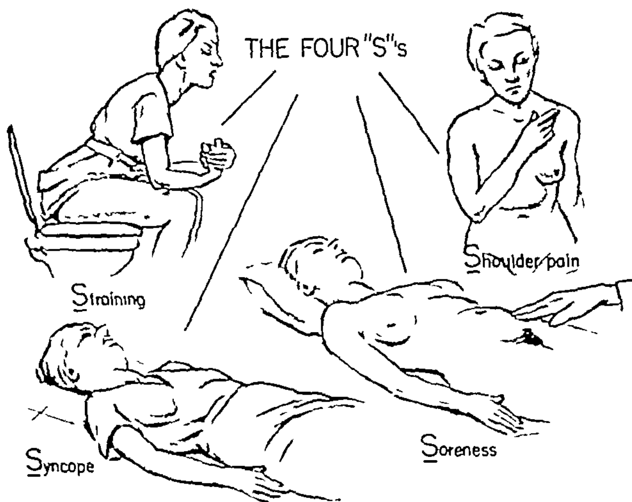


FIG. 257 In the diagnosis of ruptured tubal pregnancy the four "S s' constitute a helpful mnemonic.

cavity as the tube slowly distends and tears This condition is associated with an insidious onset but requires immediate and accurate diagnosis Constant pain although not severe is a result of tubal distention

TUBAL ABORTION

Peristalsis of the tube during the course of a tubal abortion may give rise to cramping pain (coliclike) and some localized tenderness

RUPTURED TUBAL PREGNANCY

Ruptured tubal pregnancy is a comparatively common condition with fairly characteristic signs and symptoms

The diagnosis should not be difficult if the case is typical The severity of the clinical picture depends upon the amount of blood loss and the acuteness of the rupture Sudden lancinating pain is always present. Often it is precipitated by such exertion as is associated with defecating voiding lifting or copulating The patient frequently relates the story that while straining at stool this severe pain struck like "a bolt out of the sky " Following this onset, which frequently is associated with "fainting " a generalized soreness and tenderness develops over the entire abdomen The pain and tenderness are greater in the lower abdomen and frequently center in the right lower abdominal quadrant regardless of which tube has ruptured This is explained by the water

shed action of a redundant mesosigmoid which guides the escaping blood to the region of the appendix (Fig 254) Rarely do the symptoms subside enough to permit the patient to continue her usual daily routine. About 20 per cent of these patients complain of pain in the region of the shoulder or the supraclavicular area. This is explained by the fact that blood moves under the diaphragm and irritates the phrenic nerve (Fig 257)

Shock, or a shocklike picture, probably prostration (p 267) is present in about 25 per cent of these patients.

The menstrual history of such patients usually reveals some irregularity Normal menses may be absent, or abnormal uterine bleeding may occur Over half of these women give a history of having amenorrhea followed by a spotty type of uterine bleeding however there is no characteristic type of menstrual irregularity

Secondary signs of pregnancy such as the presence of colostrum and enlargement of the breasts and the uterus are helpful if present.

Physical examination reveals *abdominal tenderness* in all cases with the exception of those patients who are prostrate The tenderness is found more frequently on the right because more ectopic pregnancies involve the right tube and, as stated, the path along the mesosigmoid directs blood from ruptured tubes to the right side Rigidity is mild and not too significant The author has yet to see a positive Cullen s sign (bluish discoloration in the umbilical region) in his 25 years of practice It must be very rare

Pelvic examination is most helpful The cervix feels soft and appears bluish Any movement or manipulation of it results in excruciating pain This is noted in over 80 per cent of the cases it must be elicited gently In well over half of the cases a definite tender mass or bulging can be felt in the fornices or the posterior cul-de-sac. Some enlargement of the uterus may also be present The gloved examining fingers should be inspected for the presence of a dirty brownish discharge which is characteristic of tubal pregnancies this is in contrast with the copious bright red blood seen in threatened uterine abortions Gynecologists and obstetricians have stressed the importance of aspiration of the posterior cul-de-sac. They state that the demonstration of a hemoperitoneum is an accurate method of diagnosing ectopic pregnancy (Fig 258)

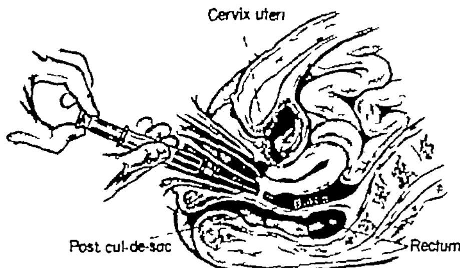


Fig 258 The demonstration of a hemoperitoneum by aspiration of the posterior cul-de-sac.

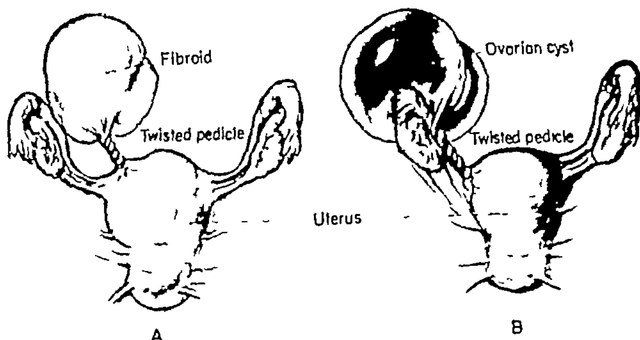


Fig 259 The most common pelvic masses that may twist are pedunculated uterine fibroids and ovarian cysts.

Laboratory aids are not completely reliable or specifically diagnostic. The red blood cell count is rarely under 3 000 000 unless the hemorrhage has been massive The various hormonal tests, sedimentation rate white blood count or diagnostic curettage may give contributory evidence but are *not thoroughly reliable*

The differential diagnosis is essentially that of the "acute abdomen."

TWISTED PEDICLES

Any intra abdominal mass that is pedunculated may twist the most common are ovarian cysts and uterine fibroids (Fig 259) The nature and the degree of pain varies with the degree of torsion If the torsion is complete the pain is so severe that it is difficult to control with opiates If however it is incomplete or if detorsion takes place the onset is gradual and the pain is negligible Torsion of any viscus is associated with vomiting This occurs almost as soon as the pain appears so that there is a short interval or no interval between the initial pain and vomiting The pain is located in the lower abdomen and tenderness is frequently unilateral until a spreading peritonitis sets in The pain has a tendency to radiate down the thighs If the torsion is complete and the blood supply to the viscus is occluded shock or a shocklike picture becomes evident Fever and leukocytosis increase as the twisted viscus becomes necrotic In most instances a mass is palpable abdominally, vaginally or by means of a bidigital examination (Fig 136) When rigidity is marked it becomes difficult to outline the mass.

ENDOMETRIOSIS

This condition implies endometrial invasion of tissues and areas that are foreign to it The most common sites are the uterus the ovaries and the pouch of Douglas Extragenital locations include the bowel, the umbilicus the bladder or the ureter (Fig 260) Although this condition is common it frequently is undiagnosed or misdiagnosed because the history is either not properly taken or interpreted.

shed action of a redundant mesosigmoid which guides the escaping blood to the region of the appendix (Fig 254) Rarely do the symptoms subside enough to permit the patient to continue her usual daily routine. About 20 per cent of these patients complain of pain in the region of the shoulder or the supraclavicular area. This is explained by the fact that blood moves under the diaphragm and irritates the phrenic nerve (Fig. 257)

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The menstrual history of such patients usually reveals some irregularity Normal menses may be absent, or abnormal uterine bleeding may occur Over half of these women give a history of having amenorrhea followed by a spotty type of uterine bleeding however there is no characteristic type of menstrual irregularity

Secondary signs of pregnancy such as the presence of colostrum and enlargement of the breasts and the uterus are helpful if present.

Physical examination reveals *abdominal tenderness* in all cases with the exception of those patients who are prostrate. The tenderness is found more frequently on the right because more ectopic pregnancies involve the right tube and as stated, the path along the mesosigmoid directs blood from ruptured tubes to the right side Rigidity is mild and not too significant The author has yet to see a positive Cullen s sign (bluish discoloration in the umbilical region) in his 25 years of practice It must be very rare

Pelvic examination is most helpful The cervix feels soft and appears bluish. Any movement or manipulation of it results in excruciating pain This is noted in over 80 per cent of the cases it must be elicited gently *In well over half of the cases* a definite tender mass or bulging can be felt in the fornices or the posterior cul-de-sac. Some enlargement of the uterus may also be present. The gloved examining fingers should be inspected for the presence of a dirty brownish discharge which is characteristic of tubal pregnancies this is in contrast with the copious bright-red blood seen in threatened uterine abortions. Gynecologists and obstetricians have stressed the importance of aspiration of the posterior cul-de-sac. They state that the demonstration of a hemoperitoneum is an accurate method of diagnosing ectopic pregnancy (Fig 258)

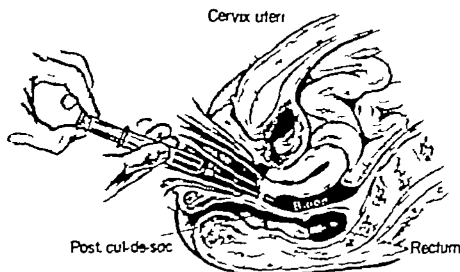


FIG. 258 The demonstration of a hemoperitoneum by aspiration of the posterior cul-de-sac.

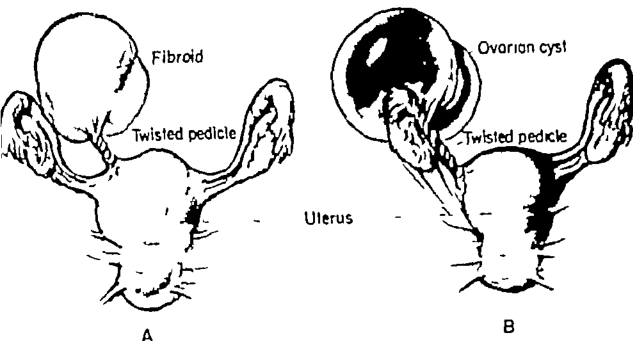


FIG 259 The most common pelvic masses that may twist are pedunculated uterine fibroids and ovarian cysts

Laboratory aids are not completely reliable or specifically diagnostic. The red blood cell count is rarely under 3,000 000 unless the hemorrhage has been massive The various hormonal tests sedimentation rate white blood count or diagnostic curettage may give contributory evidence but are not thoroughly reliable

The differential diagnosis is essentially that of the "acute abdomen"

TWISTED PEDICLES

Any intra-abdominal mass that is pedunculated may twist the most common are ovarian cysts and uterine fibroids (Fig 259) The nature and the degree of pain varies with the degree of torsion If the torsion is complete the pain is so severe that it is difficult to control with opiates If, however it is incomplete or if detorsion takes place the onset is gradual and the pain is negligible Torsion of any viscus is associated with vomiting This occurs almost as soon as the pain appears so that there is a short interval or no interval between the initial pain and vomiting The pain is located in the lower abdomen, and tenderness is frequently unilateral until a spreading peritonitis sets in The pain has a tendency to radiate down the thighs If the torsion is complete and the blood supply to the viscus is occluded, shock or a shocklike picture becomes evident Fever and leukocytosis increase as the twisted viscus becomes necrotic In most instances a mass is palpable abdominally, vaginally or by means of a bidigital examination (Fig 136) When rigidity is marked it becomes difficult to outline the mass

ENDOMETRIOSIS

This condition implies endometrial invasion of tissues and areas that are foreign to it The most common sites are the uterus the ovaries and the pouch of Douglas Extragenital locations include the bowel the umbilicus the bladder, or the ureter (Fig 260) Although this condition is common it frequently is undiagnosed or misdiagnosed because the history is either not properly taken or interpreted.

shed action of a redundant mesosigmoid which guides the escaping blood to the region of the appendix (Fig 254) Rarely do the symptoms subside enough to permit the patient to continue her usual daily routine. About 20 per cent of these patients complain of pain in the region of the shoulder or the supraclavicular area. This is explained by the fact that blood moves under the diaphragm and irritates the phrenic nerve (Fig 257)

Shock, or a shocklike picture, probably prostration (p 267) is present in about 25 per cent of these patients

The menstrual history of such patients usually reveals some irregularity Normal menses may be absent, or abnormal uterine bleeding may occur Over half of these women give a history of having amenorrhea followed by a spotty type of uterine bleeding however, there is no characteristic type of menstrual irregularity

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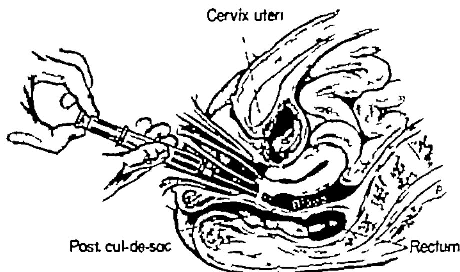


FIG 258 The demonstration of a hemoperitoneum by aspiration of the posterior cul-de-sac.

believe that shotty nodules in the region of the uterosacral ligaments are the earliest and most frequent findings Such nodules are dependent upon the location of the endometrial implants they may be felt in the region of the ovary or the anterior and the posterior cul-de-sacs Cystoscopy may reveal involvement of the bladder The final diagnosis rests with the microscopic demonstration of endometrial tissue

RUPTURED GRAAFIAN FOLLICLE

This condition must be included in the differential diagnosis of acute abdominal conditions This diagnosis should be considered in any woman who gives a history of acute abdominal pain that occurs in the intermenstrual period The severity of the symptoms is dependent upon the amount of intraperitoneal hemorrhage Tenderness and bulging may be present in the posterior cul de sac. Adnexal tenderness is most marked on the side on which the rupture occurred This condition is most frequently confused with acute appendicitis ruptured ectopic pregnancy or salpingitis

Acquired dysmenorrhea and/or progressive dysmenorrhea should make one suspicious of endometriosis When the complaint of painful periods is elicited it must be determined whether or not such periods have been present since menarche It will be found that these patients state that their periods were normal and painless until a given time when pain became apparent

The dysmenorrhea becomes progressively worse with succeeding cycles When endometriosis affects the ovary it frequently produces the so-called 'chocolate or tarry' cyst (retained menstrual blood) If such a cyst ruptures severe peritoneal irritation results

Acquired dyspareunia is a frequent complaint. These patients state that sexual intercourse has become painful, whereas prior to a given time it was not. Other causes may be responsible for this symptom however it should suggest the possibility of endometriosis

Other symptoms include pelvic pain infertility and abnormal (usually excessive) menstruation Cyclic bleeding from the rectum periodic attacks of intestinal obstruction at the time of the menstrual period backache, and pain in the region of the groin and the umbilicus may be present. If backache is due to a retro displaced uterus it is readily relieved by a well fitted pessary This would not be so in endometriosis.

Physical examination frequently reveals a shotty sensation posterior to the cervix, this can be felt per rectum Some authorities

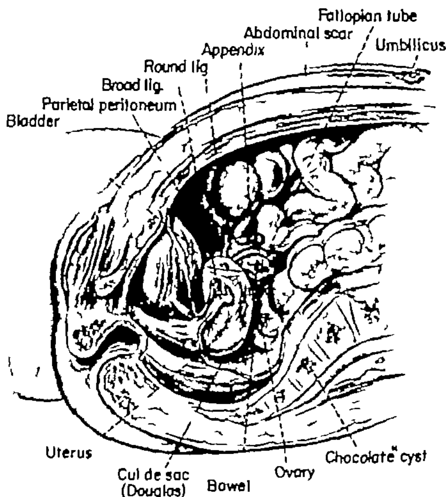


FIG. 260 Some sites of endometrial implants.

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13

Abdominal Injuries

The diagnosis of a serious intra abdominal injury is not always possible immediately after the accident Frequently, trauma without visceral injury causes enough disturbance to the nervous system to produce an initial period of collapse An injury to the *deep epigastric vessels* with hemorrhage into the anterior abdominal wall may be equally confusing To add further to the diagnostician's dilemma is the fact that retroperitoneal hemorrhage and/or a fracture of the spine are frequently followed by ileus It is a truism that delay encourages deterioration, however, watchful expectancy (3 to 6 hours) is permissible when the diagnosis is doubtful It is incumbent upon the clinician to be on guard for signs and symptoms of *shock, hemorrhage* and *infection*

Any injury to the abdominal wall however slight, may be accompanied by serious lesions of the contained viscera. Since the signs and symptoms of intraperitoneal mischief are often equivocal for some hours, it becomes mandatory to examine the abdomen at *half hour intervals* These examinations should be done by the *same individual*

A plan must be followed in evaluating a patient who has sustained trauma to the

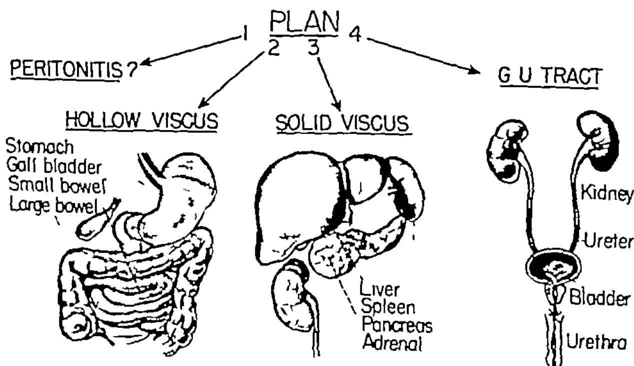


FIG. 261 A workable plan which aids the clinician in evaluating the "traumatic abdomen"

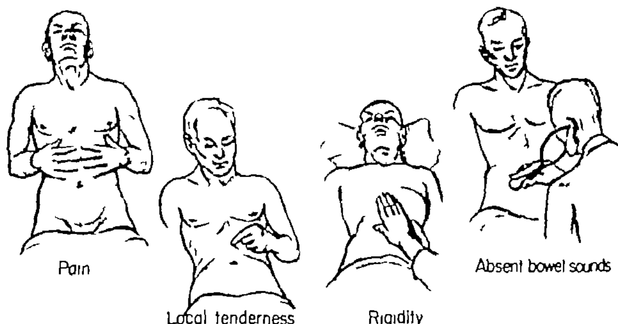


FIG 262 Early signs and symptoms of peritonitis are depicted. These are dependent upon the degree of peritoneal soiling.

abdomen When one possesses such a definite plan valuable time is saved, no organs are overlooked and proper therapy is instituted readily The plan that has been most successful in the author's hands is one in which 4 questions are considered (Fig 261)

1 Are signs of peritonitis present?
2 Is a hollow viscus injured?
3 Is a solid viscus injured?

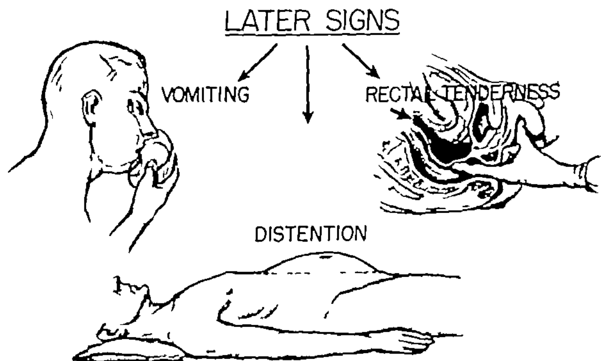


FIG 263 Signs of later and/or far advanced peritonitis.

4 Is the genito-urinary tract injured?

It is possible that multiple injuries may be present

ARE SIGNS OF PERITONITIS PRESENT? (Fig 262)

The more important and earlier signs of peritonitis are

Abdominal pain
Localized tenderness
Muscular rigidity
Diminution and/or absence of bowel sounds

Elevation of pulse distention pelvic peritoneal tenderness shifting dullness and vomiting are signs of far advanced peritonitis (Fig 263) If the signs subside surgical intervention is rarely indicated however if they remain stationary or increase surgical exploration is warranted Exceptions will be discussed subsequently

IS A HOLLOW VISCUS INJURED?

The hollow viscera that must be considered in abdominal trauma are the stomach duodenum, jejuno-ileum colon rectum and biliary tract

Stomach

Rupture usually occurs when this organ is full or if some pre-existing lesion produces a point of weakness Since the stomach usually contains an air bubble (magen blase) a spontaneous pneumoperitoneum is present in most cases The air bubble escapes into the peritoneal cavity and can be seen under the fluoroscope or on a flat roentgenogram (Fig 118) The patient should be examined in the sitting position or in a left lateral decubitus If free air is present it will be seen between the right hemidiaphragm and the liver No contrast media should be given the absence of free air does not rule out a ruptured stomach. The other signs of spreading peritonitis that have been enumerated are present A rare type of rupture is one in which the tear has taken place on the posterior wall of the stomach and the contents leak into the lesser peritoneal cavity (Fig 264) In such cases the early signs of peritonitis are lacking A flat roentgenogram usually discloses a hydropneumoperitoneum (fluid level) in the lesser omental sac

Small Bowel and Colon

These can be considered together The intestinal wall is sensitive only to distention therefore pain does not occur until peritonitis develops The clinical picture may be

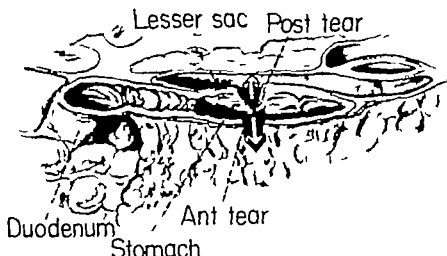


Fig. 264 Traumatic rupture of the stomach may take place anteriorly or posteriorly as the arrows indicate. Posterior ruptures leak into the lesser peritoneal cavity

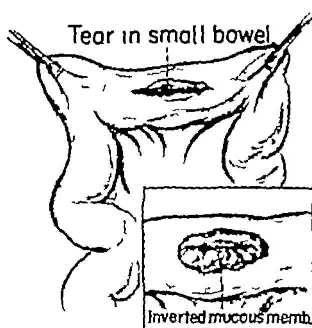


FIG. 265 A small tear in the bowel The insert shows the everted pouting *mucous membrane plugging the rent* and preventing leakage

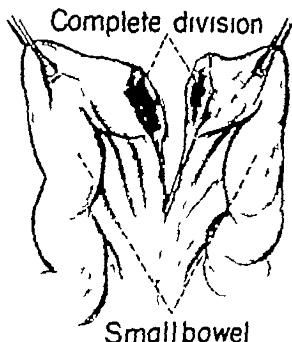


FIG. 266 The small bowel may be *completely divided. It is difficult for* the mucous membrane to plug such orifices.

delayed or confused because it is dependent upon the size of the leak, the nature of the leaking contents, and whether or not the leakage takes place into the general peritoneal cavity The tear may involve only a *portion of the circumference of the bowel.* If the rent is small the edges of the mucous membrane pout and plug the gap resulting in a negligible leak (Fig 265) A lull in the symptoms produces a sense of false security If food is permitted peristaltic activity is increased, and the rent in the bowel is reopened Spreading peritonitis then becomes *apparent. If the bowel is divided completely,* peritoneal soiling is marked and the signs *and symptoms are present early (Fig 266)* Perforation may occur at any point where the blow impinges the bowel against the vertebral column and where it is more or less fixed Such fixed points of the small bowel most *commonly occur at the duodenojejunal junction* and in the region of the terminal ileum (Fig 267) Most perforations are found 6 or 8 inches distal to the ligament of Treitz

Spontaneous pneumoperitoneum is rarely demonstrated with the roentgenogram in small bowel perforations whereas in cases of ruptured colon a spontaneous pneumoperitoneum can be demonstrated frequently *The reason for this is that gas is normally* present in the large bowel. The exact site of the lesion can be determined only by celiotomy If the colon is perforated clinical evidence of peritonitis occurs with rapidity owing to the extremely irritating quality of colonic contents.

Retroperitoneal rupture of the duodenum *requires special mention* (Fig 268) The mortality is unusually high because of the difficulty in locating and repairing the rent. In over half of the cases the tear is retroperitoneal as a result of this, signs of peritonitis are wanting and treatment is delayed. These patients frequently have *pain which is referred to the right loin* although they appear ill they are usually ambulatory and the seriousness of their injury is overlooked Bowel sounds are usually

normal or slightly diminished, and tenderness can be elicited only on deepest pressure The flat roentgenogram may reveal scattered air in the retroperitoneal tissue or around the right kidney Such findings are quite pathognomonic Although the early symptoms are deceptively mild the later ones are tragically grave

BILIARY TRACT (FIG 269)

These injuries are rare they usually result from a vehicle passing directly over the

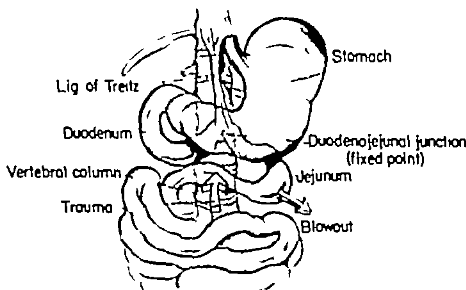


FIG 267 The mechanism of a ruptured jejunum following trauma

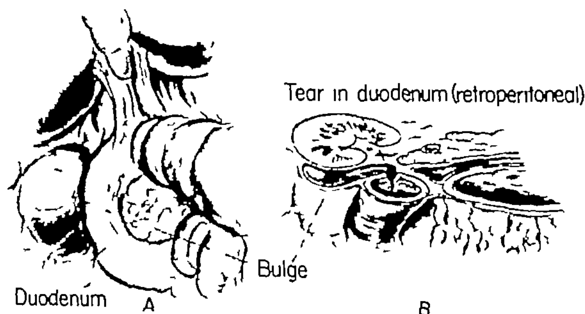


FIG 268 Retroperitoneal rupture of the duodenum may be overlooked because of the late appearance of signs and symptoms of peritonitis.

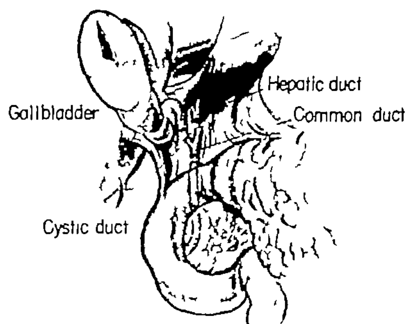


FIG 269 Possible structures involved in an injury to the biliary tract.

abdomen It is unlikely that a correct preoperative diagnosis will be made, since the signs and symptoms are identical with those of rupture of the small intestines. If the leak is great, chemical irritation from bile will result in rather rapid spreading and severe peritonitis The presence of bile in the peritoneal cavity is not pathognomonic, since intraperitoneal rupture of the duodenum may also be associated with biliary peritonitis Jaundice appears after a few days Peritoneal aspiration in search for bile is not advocated Such peritoneal "taps" are not without danger

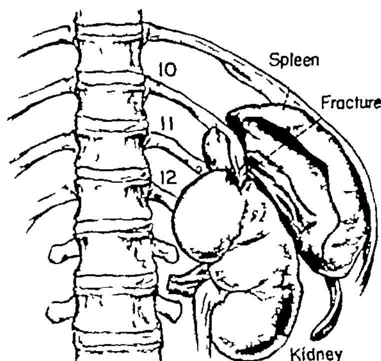


FIG 270 Because of the close anatomic relationships of the spleen, the kidney and the tenth rib, a combination of injuries must be suspected when one of these structures is injured.

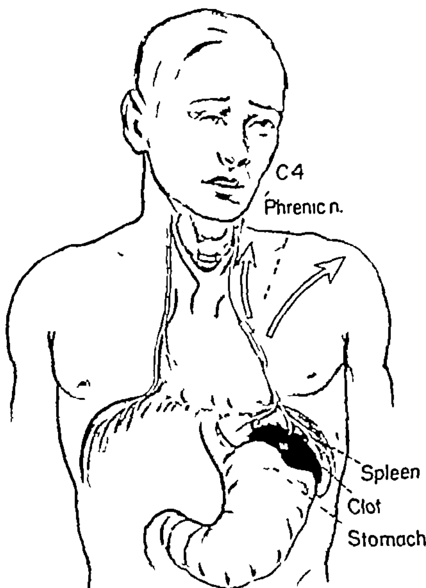


FIG 271 A splenic hematoma produces pain in the left shoulder because of pressure on the left phrenic nerve The displacement of the stomach should be noted

IS A SOLID VISCUS INJURED?

The abdominal cavity contains 5 solid viscera they are the liver, spleen, kidney, pancreas and adrenals Four of these will be considered here the kidney is discussed under the heading of genito-urinary tract.

SPLEEN

Trauma to this organ must be diagnosed early if these patients are to be saved. The classical picture presents no diagnostic difficulties however atypical splenic ruptures may lead to serious errors Three types of rupture must be kept in mind namely, rupture with hemorrhage into the peritoneal cavity rupture of the splenic parenchyma with subcapsular or retroperitoneal hematoma and delayed rupture of the spleen

Injury to this viscus must be suspected when there is tenderness in the left upper quadrant evidences of shock and internal hemorrhage, and injuries to the lower left ribs particularly the tenth The spleen may be injured at the same time that the left kidney has sustained trauma, hence, whenever a hematuria is present a splenic rupture should be considered also (Fig 270) Auscultation of the abdomen usually reveals diminished amount or absence of bowel sounds When the classical type with diffuse hemorrhage is present, a massive perisplenic hematoma results The author has found it

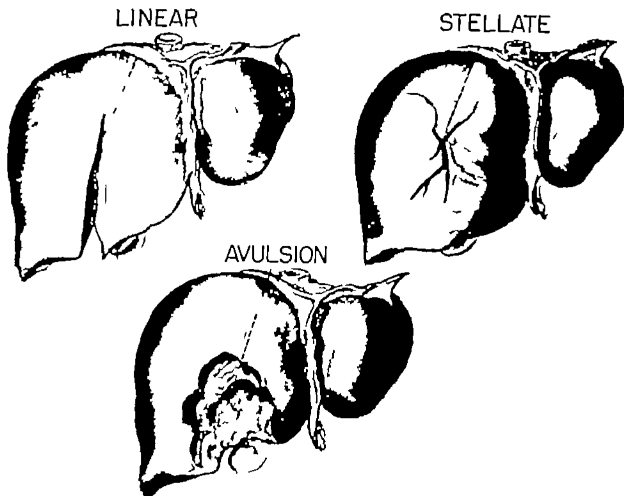


Fig 272 Types of injury that may affect the liver following trauma.

particularly difficult to palpate a normal or even somewhat enlarged spleen however it is easy to percuss the spleen, be it normal or enlarged The normal spleen is approximately the size of the palm of the hand If one percusses downward along the midaxillary line, splenic dullness is located in the region of the eighth or ninth rib this dullness continues to the tenth rib or slightly below In the event of splenic rupture with massive bleeding this area of normal splenic dullness is increased because of the surrounding clot Organs in the immediate vicinity may be displaced. This displacement can be identified by means of a flat roentgenogram (Fig 271) The splenic hematoma displaces the gastric air bubble to the right, and the splenic flexure downward and medially If there is insufficient air in the stomach this may be introduced through a Levin tube this is safer than producing dilatation by means of a carbonated drink, since there may be associated gastro-intestinal damage. Obliteration of Traube's space is present. Traube's space is bounded above by the lower border of the lung on the right by the liver below by the costal margin, and on the left by the spleen Normally when percussed this space produces a tympanitic note If the patient's condition warrants fluoroscopic examination might reveal limitation of motion, or elevation of the left hemidiaphragm Complaint of left shoulder pain is suggestive of a splenic injury this results from an irritation of the left phrenic nerve which is transmitted upward to its origin at C4 (Fig 271) Of particular diagnostic value is the production of splenic

pain when pressure is maintained behind the sternocleidomastoid on the scalenus anticus muscle immediately above the left clavicle (Fig. 271) The chemical and irritating action of blood in the peritoneal cavity causes an ileus and absence of bowel sounds Blood loss is revealed by pallor, a falling hematocrit and increased pulse the heart sounds are heard clearly over the midabdomen since fluid acts as a conductor

With subcapsular hemorrhage no blood escapes into the peritoneal cavity and pain and tenderness if present are minimal and in the left upper abdominal quadrant A persistent unexplained anemia might be the most prominent sign however enlargement of the spleen is also significant

Delayed rupture of the spleen results from hemostasis or trifling leakage into the peritoneal cavity The quiescent period may vary from days to weeks at the end of which time the capsule tears and a sudden dramatic hemorrhage occurs The clinical picture becomes the classic one of ruptured spleen Failure to elicit the history results in delayed diagnosis

Liver

This organ usually fractures in a stellate fashion however the injury may be a simple linear one or a severe avulsion (Fig 272) The right lobe is involved 6 times as often as the left Since the force necessary to rupture the liver is more severe than that for the spleen associated injuries are common and add to the diagnostic difficulties Sixty per cent of patients with ruptured livers have other injuries 20 per cent involve the right kidney or lung and 35 per cent have fractures of the lower right ribs Diagnosis of a ruptured liver is difficult because the clinical manifestations depend almost entirely upon internal hemorrhage If the capsule is torn bleeding is profuse and produces a marked peritoneal reaction This is accompanied by right upper abdominal pain tenderness and rigidity of the abdominal muscles If the bleeding continues the symptoms of progressive hemorrhage and spreading peritonitis become apparent In bleeding from the dome of the liver, blood accumulates in one of the subphrenic spaces and may give rise to right shoulder pain If the diaphragm is torn blood accumulates in the right pleural cavity Jaundice usually appears in several days It is expedient to do repeated icterus indices or serum bilirubin determinations to discover a subclinical jaundice The author has been particularly fearful of needle aspiration of the abdomen in search of blood or bile Roentgenograms with the patient erect are especially helpful to determine the position of the diaphragm the evidence of injury to overlying ribs and the possibility of fluid in the right pleural cavity

Pancreas

The position of the pancreas within the upper abdomen usually affords it excellent protection from injury However its fixed position in front of the spine makes it vulnerable to those injuries associated with great force applied to the anterior abdominal wall As in all other injuries one must be aware of the variations of intensity of signs and symptoms which are dependent upon the degree of injury Trauma to surrounding organs further adds to the diagnostic difficulties The pain is usually located supra umbilically depending upon whether the head the neck the body or the tail of the organ is involved It also may involve the lumbar region A characteristic complaint is that the pain is exaggerated when the patient is on his back but is relieved when he is in a sitting or prone position (Fig 199) Traumatic pancreatitis may result autodigestion gives rise to the familiar picture of acute hemorrhagic pancreatitis with its associated sanguinous peritonitis and fat necrosis (p 212) The hemorrhage and the peritonitis that result may involve the lesser and/or the greater peritoneal cavities The main complication to be considered is pseudocysts (p 218) These are dif

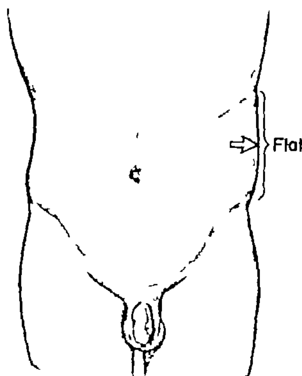


FIG 273 Flattening of the normal contour of the loin suggests an injury (hematoma) or mass involving the kidney

ferentiated from the true cysts in that the pseudocyst has no true capsule

ADRENAL GLAND

Traumatic involvement of this organ is rare There are no diagnostic signs usually it is associated with injury to surrounding organs The trauma is discovered coincidentally upon exploration

IS THE GENITO-URINARY TRACT INJURED?

Since the kidney is a solid viscus and the ureters the bladder and the urethra are hollow viscera it is best that the genito-urinary tract be considered as a unit. It is with a degree of anatomic license that the urethra is included with the abdominal organs In any injury to the genito-urinary tract hematuria is the outstanding finding This necessitates an evaluation of each one of the organs in this tract Meteorism which frequently accompanies retroperitoneal injuries, requires careful evaluation.

KIDNEY

Hematuria pain, and/or tenderness in the renal area and a mass in the flank suggest an injury to the kidney To demonstrate such a mass is difficult, however if one looks for a flattening of the normal contour of the loin, renal involvement on that side must be considered (Fig 273) This is accomplished readily if one merely lowers the bed covers and compares both loin outlines It is helpful to divide kidney injuries into 3 major groups. Group 1 consists of a simple contusion with or without minor parenchymal damage Group 2 reveals major parenchymal damage often associated with rupture of the true kidney capsule and extravasation of blood and urine into the perirenal tissues Group 3 includes the shattered kidney with gross disruption of the normal architecture and loss of a recognizable pelvis The clinical picture of Group 3 is similar to that of Group 2 except that the signs and symptoms or blood loss and shock are more marked In Group 1 the clinical symptoms are minimal Of immense diagnostic aid are the excretory urogram and the retrograde pyelogram If injury to the kidney is suspected, a flat roentgenogram should be obtained. This may be helpful in that it may reveal distortion and an obliteration of the psoas shadow on the involved side However this is not sufficient and should be combined with pyelography as soon as possible Opinions differ concerning the value of intravenous pyelography however the consensus suggests that this should be the first step in the urologic examination Although it may be inadequate and disappointing in some cases it frequently furnishes the necessary information this is particularly true of the Group 1 lesions The procedure is easily executed and often replaces cystoscopy It can be repeated at periodic intervals and carried out at the bedside If the results of intravenous pyelog

raphy are inconclusive or if doubt exists then retrograde studies must be made. In the Group 2 lesions urographic study reveal evidence of parenchymal fracture and perirenal hematoma. In the Group 3 lesions in which the kidney is shattered the roentgen studies reveal the gross disruption and loss of a recognizable kidney pelvis.

Ureter

Fortunately the ureters are well protected mobile and have elastic walls that resist ordinary trauma hence, injury from external trauma is rare. Intravenous pyelography or retrograde pyelo-ureterography usually clinches the diagnosis. If the injury is mild few or no symptoms are present. If the ureter is severely traumatized denuded or torn extravasation of urine results. This is detected readily by means of dye studies.

Bladder and Urethra

Although the urethra is not an abdominal organ it cannot be separated in a discussion of injury to the genito-urinary tract. It is permissible to include it as an appendage of the bladder.

In both ruptured bladder and ruptured urethra, a hematuria is usually present. There is frequently a desire to urinate but an inability to do so. If the patient is able to void the urine should be collected in 2 portions. An equally bloody urine in both specimens is indicative of trauma to the bladder or the upper urinary tract. Blood in the first specimen and not in the second is indicative of injury to the genital tract.

Bladder injuries have been classified as simple contusion intraperitoneal rupture and extraperitoneal rupture. The intraperitoneal type is seen commonly in patients who have had blows to the lower abdomen; it occurs most commonly when the bladder is full. The extraperitoneal rupture is associated more commonly with fractures of the bony pelvis. In these cases recovery is directly dependent upon prompt recognition and treatment. Because of this, many authorities have abandoned the early routine usage of catheterization irrigation tests and cystoscopies. The most reliable diagnostic procedure is *cystography*.

A satisfactory program is the following: a scout roentgenogram of the abdomen and the bony pelvis is taken. This is followed by an intravenous urogram; this supplies information regarding the presence of 2 kidneys and some evaluation as to their function. After the 30-minute film even though the bladder shadow suggests no evidence of extravasation the patient is catheterized and a retrograde cystogram is done.

If the sterile catheter cannot be passed into the bladder and there is bleeding from the external urethral meatus, then one must rule out a rupture of the membranous or prostatic urethra. To demonstrate such a lesion a urethrogram is done. This will reveal the location and the extent of the rupture.

14

Superior Extremity The Hand

Only *the hand* will be considered in this chapter Numerous specialized texts dealing with the superior extremity particularly orthopedic conditions are available

Because of its prehensile function the hand and the fingers are exposed to injury Although such injuries may be slight they permit the introduction of micro-organisms If such infections are not diagnosed and treated early loss of limb or life may result

PERIPHERAL NERVE INJURY

This lesion must be detected immediately It would be a rare clinician who remembers the minute details of the nerve supplies to the extremities to say nothing of the numerous anomalies When one examines a hand one must have at his disposal simple tests that detect injuries to the 3 main nerves namely, median ulnar and radial The sen

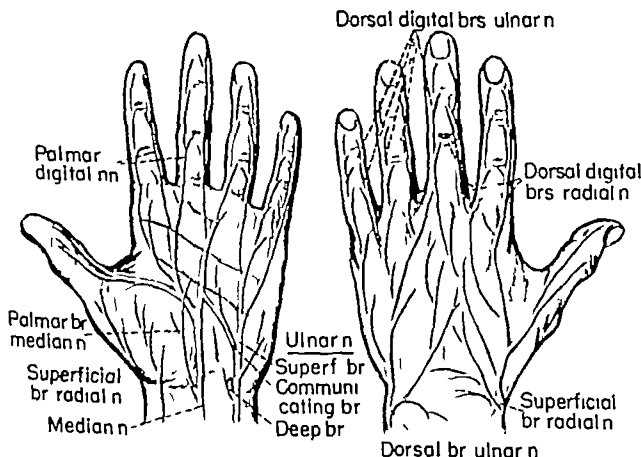


FIG 274 The sensory nerve supply of the hand

sory nerve distribution to the hand is depicted in Figure 274 In the vast majority of cases an injured nerve may be diagnosed by testing one function When a single test is used for a major nerve the most distal functions should be tested If these suggest nerve injury then all functions of the involved nerve should be analyzed and the extent of the injury determined

Tests for the ulnar nerve are accomplished readily in the following way

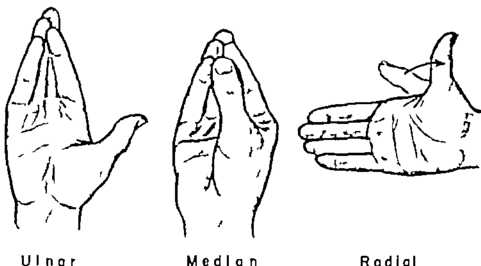
1 Sensory pinprick sensation over the palmar surface of the distal phalanx of the fifth finger

2 Motor the ability to make a "4-fingered cone (Fig 275)

Tests for median nerve injury

1 Sensory pinprick sensation over the palmar surface of the distal phalanx of the index finger

2 Motor the ability to make a "5-fingered cone' (Fig 275)



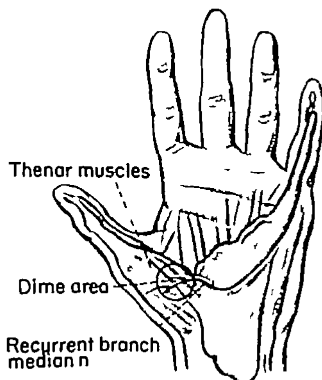


FIG 275 (*Top*) Rapid Testing of the hand for nerve injury If the patient can make a "4-fingered cone" the ulnar nerve is intact. The *ability to approximate* the thumb and make a 5-fingered cone *implies a normal median nerve* The radial nerve is the extensor" nerve. The "trigger' test of the thumb is pathognomic of its normalcy

FIG 276 (*Left*) The "dime area." If a dime is placed over the summit of the thenar eminence the area is readily outlined. The recurrent branch of the median nerve lies very superficially in this area.

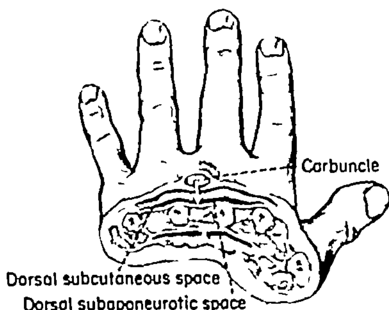


FIG. 277 Carbuncle of the dorsum of the hand These infections may burrow deeper to the dorsal subcutaneous and/or the dorsal subaponeurotic spaces

Radial nerve tests

1 Sensory pinprick sensation over the dorsum on the radial side of the hand

2 Motor extend the thumb in "trigger" fashion (Fig 275)

The *dime area* must be kept in mind whenever there is an injury involving the thenar eminence (Fig 276) If a dime is placed over the summit of the thenar eminence the area is outlined Within it the recurrent branch of the median nerve enters and supplies the 3 important thenar muscles (flexor pollicis brevis abductor pollicis brevis and opponens pollicis) If this nerve is injured (it lies very superficially) the thumb becomes paralyzed and the hand loses the greater part of its usefulness

INFECTIONS

Serious hand infections may result from trivial skin injuries The most common hand infections encountered are carbuncles felon paronychia tenosynovitis space infections and infections of the bursae

CARBUNCLES

Carbuncles of the hand are found most frequently on the dorsum because of the presence of hair follicles and sweat glands The diagnosis is simple It should be treated adequately and early because if neglected it burrows deep and involves the two dorsal spaces of the hand, namely the subcutaneous space (between the skin and the extensor tendons) and the dorsal subaponeurotic (between the extensor tendon and the metacarpal bones) (Fig 277)

FELON

A felon is an infection that involves the closed space of the terminal phalanx. If this is not diagnosed and treated early osteomyelitis occurs (Fig 278) Extension of such closed space infections shuts off the blood supply to the diaphysis of the terminal phalanx. This causes aseptic bone necrosis which may become infected secondarily There are some who challenge this concept of occlusion of the digital vessel and believe that bone involvement is



FIG 278 A felon is an infection of the anterior closed space of the finger



FIG. 279 Paronychia (runaround) may progress to a stage of abscess formation under the nail root. These infections become chronic if not treated adequately

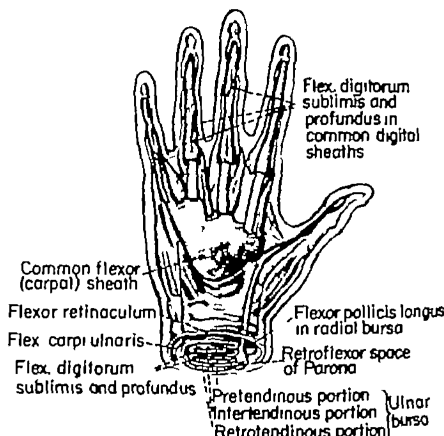


FIG 280 The most common arrangement of the flexor tendon sheaths of the fingers.

due to direct extension of the infection Both mechanisms no doubt play a role No clinician should treat a felon without having a roentgenogram of the distal phalanx first to rule out osteomyelitis Of diagnostic importance is the fact that the pain is so severe that the patient "walks the floor" and is unable to obtain relief unless a large dose of a narcotic is given One must *not* wait for suppuration or fluctuation before instituting surgical therapy The involved distal phalanx is tight tense and reddish. The patient can demonstrate the point of exquisite tenderness

PARONYCHIA

A paronychia has been called a 'run around If left untreated it may travel completely around and under the nail and form a horseshoe-shaped abscess (Fig 279) These infections usually appear spontaneously, however, there is frequently a history of injury or 'hangnail or some trauma produced in the course of a manicure In contradistinction to a felon, although the paronychia appears to be more inflamed the pain is much less. It rarely if ever requires sedation Therefore its location and different type of pain immediately differentiate it from a felon Adequate therapy results in rapid cure however *chronic paronychia* should make one suspect fungous infections which are commonly found in people whose hands are frequently immersed in water

TENDON SHEATH INFECTIONS (TENOSYNOVITIS)

Infections of the flexor tendon sheaths usually follow trauma especially injuries which occur to the transverse skin creases It is not necessary that the injury penetrate the tendon sheath This is a dangerous infec

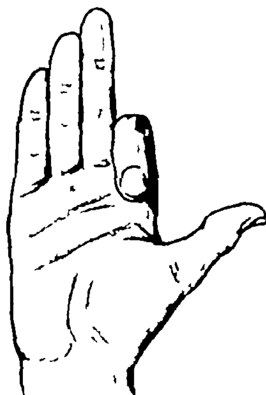


Fig 281 Flexion of the involved finger (tenosynovitis) produces the "crochet hook" sign.

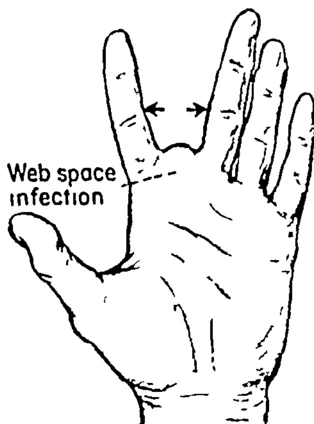


Fig 282 When the interdigital (web) space is infected and swollen the fingers to either side of the space are pushed apart.

tion since it leads to early necrosis of the tendon and permanent disability The infection may extend directly along the sheath into the hand and the forearm Particularly is this so in the case of the little finger and the thumb Figure 280 demonstrates the usual pattern of tendon sheaths however, varieties do exist

The essential signs of an infected tendon sheath are

1 Flexion of the involved finger (crochet hook sign) (Fig 281)

2 Swelling and loss of function

3 Tenderness over the infected sheath

The slightest attempt at extension produces exquisite pain however it is rarely necessary to submit the patient to such torture If the little finger is infected (tenosynovitis) the ulnar bursa may be involved similarly If the thumb is infected the radial bursa must be examined carefully Infected tendon sheaths may rupture into the interdigital web spaces If a web space is involved, the fingers to either side of this space are pushed apart (Fig 282) Web-space infections may also be present in the absence of a tenosynovitis

Tenosynovitis must not be mistaken for lymphangitis and lymphadenitis the latter presents the usual red streaks and glands (Fig 283) Lymphangitis requires nonoperative treatment, whereas acute tenosynovitis frequently requires surgical intervention

Space Infections

The fascial spaces of the hand are 2 in number, namely the middle palmar and the thenar

The middle palmar space lies on the ulnar side of the palm between the flexor tendons and the interossei Other infected areas of the hand may drain into it. These

Deltopectoral node

Axillary nodes

Epitrochlear nodes

Fig 283 The lymph vessels and glands of the superior extremity Hand infections may spread along these paths.

*have been indicated in Figure 284 Diagnos-*tic signs that suggest infection of this space include the usual signs of inflammation plus obliteration of the normal concavity of the palm (Fig 285) There is tenderness in the central part of the palm and the third the fourth and the fifth fingers may be held

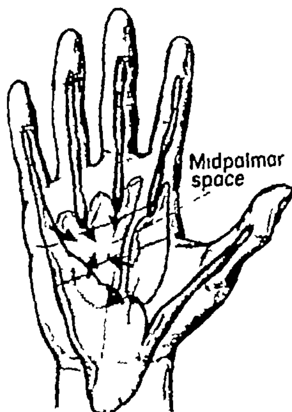


Fig 284 The midpalmar space may become infected from other foci of infection in the hand. These have been indicated by arrows.

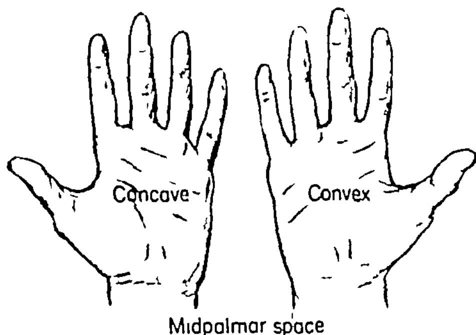


Fig 285 In midpalmar space infection the normal concavity of the palm of the hand is replaced by a slight bulging

in partial flexion Massive dorsal edema (which is frequently confusing) is also present

The thenar space is on the radial side of the palm and partly covered by the thenar muscles The possible paths of extension into this space are demonstrated in Figure 286 Involvement of this space can be diagnosed by the typical ballooning of the space between the thumb and the index finger (Fig 287) It is helpful to have the patient hold up both hands and then compare both thumb-index finger spaces to compare the normal concavity with the obliteration on the opposite side The usual signs of inflammation are present

Infections of the radial and the ulnar bursae are secondary to the involvement of the tendon sheath of the thumb and the little finger respectively The palmar spaces when involved may also involve these bursae Infections of the bursae tend to spread rapidly into the forearm and produce a necrosis of the flexor tendons

Infections of the Bursae

Involvement of the ulnar bursa is suspected when the following signs can be elicited

1 Fullness in the palm of the hand however the concavity remains

2 Fullness above the anterior annular ligament

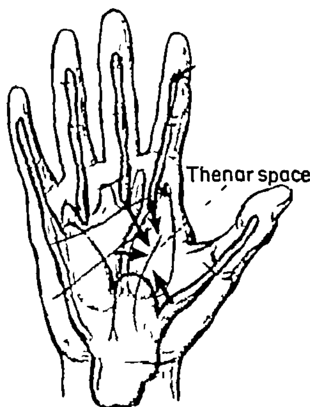


Fig 286 The possible paths of extension of infection to the thenar space are indicated by arrows.

3 Tenderness along the course of the tendon sheath of the little finger and the ulnar bursa

4 Marked edema of the dorsum of the hand

Involvement of the Radial Bursa. When this bursa is involved the following signs should be sought

1 Flexion of the distal phalanx of the thumb

2 Swelling above the anterior annular ligament

3 Tenderness over the flexor pollicis longus tendon sheath

It cannot be overemphasized that in most hand infections the dorsum of the hand swells early and massively This is explained by the fact that the areolar tissue here is loose Such swelling may attract the attention of the clinician and a misplaced incision results.

Human Bites of the Hand

These lesions deserve special mention because of some unusual features (1) the organisms introduced invade more rapidly (2) such infections tend to attack the joints, usually the metacarpophalangeal.

TUMORS OF THE HAND

Fortunately, malignant tumors of the hand are rare If a malignant neoplasm occurs here it is usually of the melanotic group Many of these, fortunately, are preceded by benign lesions which if diagnosed promptly, can be removed and cured Among the more common of such precursors may be

1 Pigmented moles and/or nevi
2 Irradiation burns
3 Keloids
4 Senile keratoses
5 Chemical burns
6 Foreign body granulomas
7 Pyogenic granulomas

When diagnosed these should be removed by wide excision

The malignant lesions as stated travel rapidly along the lymphatics (Fig 283) It should be noted that the lymphatic drainage from the thumb, the index finger and half of the third finger usually drain directly into the axillary nodes. The lymphatic drainage from half of the third ring and the little fingers drain by way of the superficial cubital nodes This does not imply that every enlarged node is a metastatic

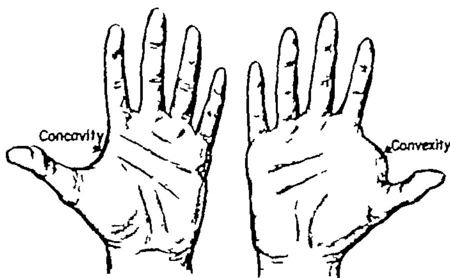


Fig 287 In thenar space infection the normal concave curve (web) between the thumb and the index finger is replaced by a convex bulging

one these may be inflammatory however it is safer to consider them malignant until proved to be otherwise

A ganglion may be considered as a mucoid tumor that occurs in the tendons (sheaths) of the hand It is found most frequently over the dorsal or volar aspect of the wrist where it attaches to the tendons and frequently to the synovia of the joint It is characterized by its mobility with a given tendon its smoothness and its cystic consistency It is benign

DUPUYTREN'S CONTRACTURE

The diagnosis of this condition is usually easy The condition is not too uncommon heredity plays a part It is not a contracture of the tendons but of the palmar fascia, usually on the ulnar side and most frequently involving the fourth and the fifth fingers The disability is due to the inability to extend these fingers there is no pain or tenderness The condition is benign and recurrences following therapy are quite common

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Inferior Extremity Varicose Veins

This chapter is devoted mainly to the subject of varicose veins This condition is the penalty that man pays for having assumed the upright posture Other etiologic factors are weakness of the venous wall and/or valves thrombosis of the deeper veins childbirth prolonged rest and trauma Associated with uncontrolled venous stasis is edema induration cellulitis and fibrosis Phlebitis and recurrent attacks of cellulitis are late symptoms and may lead to ulceration.

ANATOMY AND PHYSIOPATHOLOGY

The anatomy and physiopathology must be understood thoroughly so that a rational basis for therapy may be utilized The inferior extremity has 3 systems of veins namely superficial communicating and deep (Fig 288) All of these have valves which prevent venous reflux The patency of the veins and the competence of the valves assure successful return of blood in the proper direction When the valves become incompetent and the veins dilate the blood flow reverses its course this retrograde flow produces the pathologic changes associated with increased pressure stasis and hypoxia

Superficial Venous System

The superficial venous system is made up of the greater saphenous system (anteromedially) and the lesser saphenous system (posteromedially) The greater saphenous empties into the deep venous system at the common femoral vein and the lesser saphenous into the popliteal veins

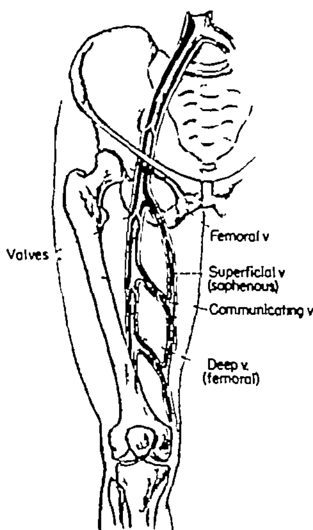


Fig 288 The normal venous circulation of the inferior extremity The arrows indicate the normal blood flow toward the heart and from superficial to deep veins.

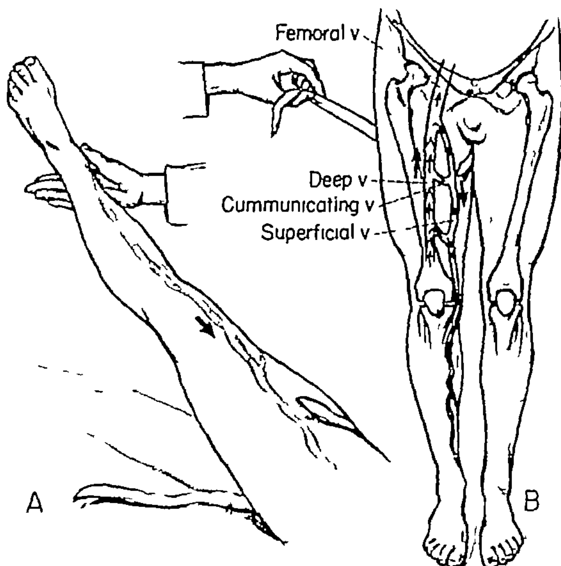


FIG. 289 The single Trendelenburg test for testing the superficial set of veins (see text)

DEEP VENOUS SYSTEM

The deep system of veins is made up of the anterior and the posterior tibial veins which become the popliteal vein this in turn becomes the common femoral vein

TESTS OF VEINS

Numerous *clinical tests* have been devised to determine the patency and function of these veins In an attempt to simplify only one test will be described for each system of veins The superficial set of veins is tested by the single Trendelenburg test the communicating veins are tested by the double Trendelenburg test and the deep set of veins by Perthes test.

SUPERFICIAL SET

The superficial set of veins is tested by the single Trendelenburg test in the following way (Fig. 289) The patient is placed in the recumbent position and the veins are emptied by raising the limb and stroking the varicosed veins in a cephalad direction. Pressure is applied over the termination of the internal saphenous vein, and with this

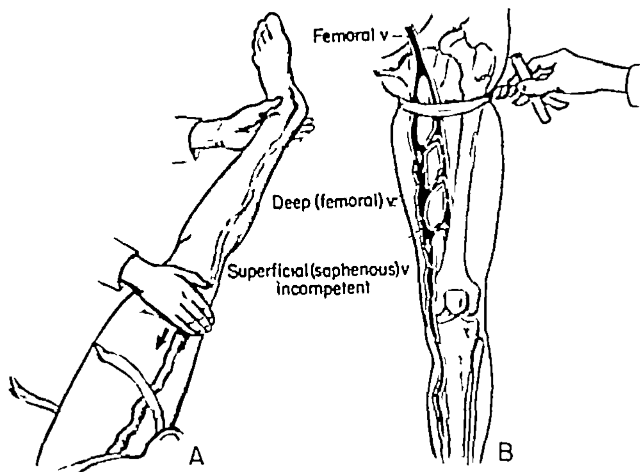


Fig. 290 The double Trendelenburg test for testing the communicating set of veins (see text)

pressure maintained the patient is asked to stand. The pressure is then released, and if rapid filling of the saphenous from above appears this indicates a positive test which signifies incompetency of the valves

Communicating Set

The communicating set is tested by the double Trendelenburg test (Fig 290) This is conducted essentially the same way as the single Trendelenburg test in that the patient is again placed in the recumbent position the superficial veins are stroked and emptied digital pressure is applied over the termination of the internal saphenous and with this pressure maintained the patient is asked to stand However the pressure in this test is maintained and not released for at least 1 minute Filling of the veins during this time suggests an incompetency of the communicating veins which connect the deep and superficial sets Should this occur the test is considered as positive and indicates the necessity for multiple ligations or stripping procedures.

Deep Set

The deep set of veins is tested by Perthes test (Fig 291) This is conducted in the following way With the patient standing and the superficial veins dilated a tourniquet is applied to the middle of the thigh. As the patient walks these dilated superficial veins should empty if the deep set is patent (Fig 291 B) However if the superficial veins become more prominent and produce pain while walking this is a positive Perthes test and indicates obstruction to the deeper

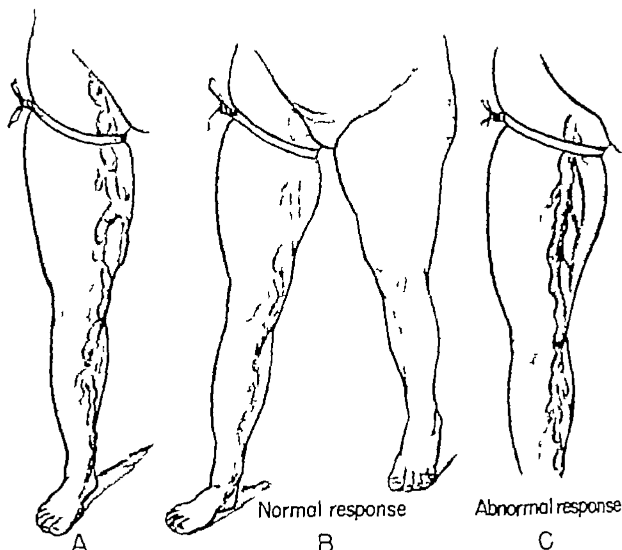


FIG 291 Perthes test is used to test the deep set of veins (see text)

set (Fig. 291 C) If the superficial veins are compensatory for a nonfunctioning deep set, great caution must be observed if any surgery is attempted on such veins.

Other tests such as the Ochsner Mahorner and double tourniquet test are helpful but rarely necessary It is well to remember that any patient who can wear an elastic stocking which collapses his superficial veins and thereby receives relief can be considered as having a competent set of deep veins

TESTS OF ARTERIES

In elderly patients it is always wise to test the arterial blood supply of the limbs Such tests as the histamine test, oscillometric readings and position changes as occur with the Samuel test are helpful. Of most practical importance however is the checking for the dorsalis pedis artery pulsation. This artery can be felt readily by drawing a line between the first toe web and the mid malleolar point The dorsalis pedis travels along this line directly lateral to the extensor hallucis longus tendon. One must not forget that this pulsation may be lacking and the circulation still be completely adequate

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